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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 4 February 28, 1959

GENERAL

1865 AECL-717

Atomic Energy of Canada Ltd., Chalk River, Ont.

THE DEBATE IN THE HOUSE OF COMMONS ON THE ATOMIC ENERGY ESTIMATES FOR 1958–1959. Sept. 3, 1958. 19p. $0.50(AECL).

Activities of Atomic Energy of Canada Limited are reviewed and objectives of that organization are outlined. Activities in the fields of fundamental research, applied research, and the development of nuclear power programs are discussed. The possibility of supplying uranium to other countries is considered. Future support of the Canadian government in the development of peaceful uses of atomic energy is discussed. (C.H.)

1866 BMI-1273

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JUNE 1958. Russell W. Dayton and Clyde R. Tipton, Jr. July 1, 1958. Decl. Aug. 4, 1958. 62p. Contract W-7405-eng-92. $1.75(OTS).

Developments for Zirconium-Clad Fuel Elements. The thermal conductivity of Zircaloy-2 clad specimens of U, U–1.5 wt. % Zr, and Zircaloy-2 was measured from 20 to 800°C prior to irradiation. Corrosion data for a 1000 hr test at 300°C in pure water of nine Zr alloys are given: Zr–Sn–Mo, Zr–Sn–Mo–Nb, Zr–Sn–Mo–Nb (trace Fe and Ni), Zr–Sn–Mo (trace Fe and Ni) Zr–Sn, and Zr–Sn (trace Fe and Ni). Developments for Aluminum-Clad Fuel Elements. Studies continued in casting Al and cladding with Al. Corrosion results are given for 15 min tests in 300°C water of U–Zr alloys with traces of V, Nb, Ni, Ti, Mo, Pt, Cr, Si, Al, and Ru in various combinations. Studies of Uranium and Uranium Alloy Fuels. Corrosion data are given for a U–Mo–Nb alloy and some U–Mo–Nb–Ru alloys in 680°F water after 672 hours. Oxidation data are given for U–Nb alloys versus time at 350 and 400°C. Corrosion Problems Associated with Separation Processes. Studies of corrosion of alloys in Darex, Sulfex-Thorex, and fluoride volatility processes are reported. Data are given for INOR-1 and INOR-8 in $NaF–ZrF_4$ at 650°C for 500 and 1010 hours. Developments for SRE, OMRE, and OMR. Casting techniques for preparation of UC were studied, and post-irradiation evaluation of SRE Th–U specimens is reported. Studies of Na–Ta Compatibility at High Temperatures. These studies continued, data being given for creep of partially-annealed arc-cast Ta at 1200°F. Other work preparatory to developmental studies for PWR, MGCR, and NMSR is described. (For preceding period see BMI-1267.) (T.R.H.)

1867

INDUSTRIAL APPLICATION OF RADIOISOTOPES AND THEIR ECONOMIC IMPORTANCE. George Manov. Bull. Inform. Assoc. belge develop. pacifique energie atomique No. 15, 15-18(1958) July. (In French)

The first part of an article on the industrial applications of radioisotopes is presented. The use of radioisotopes for radiography, thickness measurements, and density measurements is discussed. (J.S.R.)

1868

BERYLLIUM FABRICATION PROBLEMS. DEVELOPMENT WORK BY TUBE INVESTMENTS. Nuclear Power 3, 559-60(1958) Nov.

Tube Investments' new laboratory for working beryllium is described. The fabrication of beryllium tubes from ingots and the required safety precautions are discussed. (W.D.M.)

1869

THREE-DIMENSIONAL PHOTOELASTICITY AND ITS APPLICATION IN MACHINE DESIGN. M. M. Leven and A. M. Wahl (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Soc. Mech. Engrs. 80, 1683-94 (1958) Nov.

The simplest equipment, the best model materials, and the most effective techniques for three-dimensional photoelastic tests are described. The optical equipment involves only a simple diffusion polariscope using only a single camera lens. Phthalic anhydride-cured epoxy resins, which are relatively easy to cast in large sizes, have much superior properties for photoelastic tests than previously used materials. A simple technique of using surface slices and normal incidence of light will give adequate results for the stresses on free surfaces. At interior points, the effective stress can be obtained by measuring the retardation and isoclinic parameters on the three faces of random oriented small cubes. Some discussion is given regarding methods of applying the photoelastic results in practical design applications where fatigue, repeated strain cycling, plastic flow, and creep-rupture effects may occur during operation. (auth)

1870

NUCLEAR ENERGY AND THE CIVIL ENGINEER. M. F. Kaplan (S.A. Council for Scientific and Industrial Research). Trans. S. African Inst. Civil Engrs. 7 & 8, 20p. (1958).

The advent of nuclear energy has given rise to many matters with which the civil engineer is intimately concerned. Some of these are discussed, based on a review of the available literature: the design of structures to resist complicated blast forces caused by atomic

weapons, the design and construction of concrete biological shields, the disposal of radioactive wastes, the problems associated with the structural design and erection of nuclear reactors, and the use of radioisotopes, e.g. in the detection of leaks in pipelines, the study of the flow of water in rivers, and the determination of the density and moisture content of soils and concrete. The need for research is indicated. The view is expressed that because of developments in the use of nuclear energy, the civil engineer should become thoroughly versed in the basic sciences of physics and chemistry and that he will have to work in close cooperation with experts in these fields. Those reponsible for civil engineering education and research should master those aspects of knowledge of nuclear energy which are of concern to the civil engineer, so as to enable him to play his proper part in the atomic age. (auth)

1871

ABBREVIATIONS DICTIONARY. Abbreviations, Contractions, Signs & Symbols Defined. Ralph De Sola. New York, Duell, Sloan and Pearce, 1958. 189p.

An alphabetical and numerical list of abbreviations and contractions is presented. The Greek alphabet, international civil aircraft markings, numbered abbreviations, proofreader's marks, punctuation and diacritical marks, radio alphabet, Roman numerals, ship's bell time signals, and signs and symbols are also included. (J.S.R.)

1872

HOW AND WHERE TO LOOK IT UP. A Guide to Standard Sources of Information. Robert W. Murphey. New York, McGraw-Hill Book Company, Inc., 1958. 730p.

A systematic organization of the major works of information is presented. An introductory chapter discusses reference works and their use. The basic types of reference sources are listed and described. The final part of the book lists reference books for people, places, and things. (J.S.R.)

1873

REPORTS ON THE PRODUCTIVE USES OF NUCLEAR ENERGY. NUCLEAR ENERGY AND WORLD FUEL PRICES. Cornelius J. Dwyer. Washington, National Planning Association, 1958. 84p. $1.25.

In a review of the prospective fuel supply and demand situation, the various geographic price patterns that may develop are outlined. The nature of interfuel competition is discussed and a simplified example is given. Demand and supply are reviewed. The competition of fuel oil with coal and nuclear energy in western Europe and the east coast of the United States is investigated. Prices and geography are surveyed. It is concluded that the rate of nuclear development over the next five or ten years will be determined more by political factors than by economic ones. However, large-scale nuclear power plants are expected to become truly competitive in the middle 1960's in the high energy cost areas of the world. (J.S.R.)

1874

ATOMIC WEAPONS AND ATOMIC DEFENSE. Aleksey Petrovich Glushko, Leonid Kuz'mich Markov, and Lev Pavlovich Pilyugin. Moscow, Voyen. izd-vo M-va obor. SSSR, 1958. 391p.

An outline of the problems of atomic warfare and the principles of defense is presented. An introductory chapter on the structure of matter and atomic energy is given. The atomic weapons in use at the present are described. In the discussion on the effects of an atomic explosion, separate chapters are devoted to the shock wave, luminous radiation, and penetrating radiation. The radioactive contamination of areas by atomic explosions is considered. The defense of troops and the use of atomic bomb shelters are discussed. Radiation research and dosimetry, safety measures for protection of army personnel in contaminated areas, and decontamination procedures are reviewed. (J.S.R.)

BIOLOGY AND MEDICINE

1875 AECU-3891

Wayne State Univ., Detroit. Coll. of Medicine.
STUDIES ON THE EFFECTS OF MATERNALLY ADMINISTERED PHOSPHORUS-32 ON FOETAL AND POST-NATAL DEVELOPMENT OF THE RAT. Final Technical Report. James E. Lofstrom. [1957]. 56p. Contract AT-(11-1)-412.

Pregnant female mice were injected intraperitoneally with various doses of high specific activity phosphorus-32 after 14 or 17 days of gestation. A comprehensive picture is presented of the effects of internal irradiation on the fetus at various stages of gestation. An evaluation was made of the role of sensitation dose rate and radiation energy in bringing about differences observed in effects of external x irradiation and internally deposited radiophosphorus. (See also A/Conf.15/P/902.) (C.H.)

1876 AECU-3893

Utah State Agricultural Coll., Logan.
THE EFFECT OF THE LEVEL OF NUTRITION ON THE PATHOLOGY AND PRODUCTIVITY OF RANGE SHEEP. Progress Report No. 4 and Final Report [for] January 15, 1957 to April 15, 1958. 42p. Project 423. Contract AT(11-1)-297. $7.80(ph OTS); $3.30(mf OTS).

Utah ranchers reported unusual lesions on sheep grazing in the vicinity of the atomic weapons tests. Pathological lesions observed are described. An investigation was made of the effect of range conditions and vigor of plants upon the nutritive value and productivity of palatable forage. The effect of the level of nutrition in range ewes on the maintenance of body weight, lamb crop, and weight and quality of wool was investigated. Information obtained from ranchers on their present practice in raising sheep is included. (C.H.)

1877 AECU-3894

Johns Hopkins Univ., Baltimore.
THE RELEASE AND STABILITY OF THE LARGE SUBUNIT OF DNA FROM T_2 AND T_4 BACTERIOPHAGE. Charles A. Thomas, Jr. [1958]. 46p. Contract AT(30-1)-2119. $7.80(ph OTS); $3.30(mf OTS).

Bacteriophages labeled with phosphorus-32 were grown in E. coli. After purification the bacteriophages were exposed to various treatments which are known to release the encapsulated desoxyribonucleic acid. The reaction products were examined by autoradiography. Observations on the release of desoxyribonucleic acid and phage structure are reported. (C.H.)

1878 AECU-3897

New York. State Univ. Veterinary Coll., Ithaca.
THE EFFECT OF X-IRRADIATION ON A MEGAKARYOCYTOSIS PRODUCED IN GELATIN TREATED ANIMALS. Progress Report. Irwin M. Murray and Arlene R. Seaman. [1945]. 4p. Contract AT(30-1)-2080. $1.80(ph OTS); $1.80(mf OTS).

An increase in the number of megakaryocytes in the spleen and bone marrow of rats was observed by histological examination of samples following the intravenous injection of gelatin. No significant change was observed in the platelet count or red and white blood cell counts. There was no real difference in the clotting time of the blood from the experimental and control groups. (C.H.)

1879 AECU-3911

Roscoe B. Jackson Memorial Lab., Bar Harbor, Me.

PHYSIOLOGICAL STUDIES ON CONGENITAL DEFORMITY IN MICE. Progress Report and Fourth Renewal Proposal. Report Period: September 1, 1957–August 31, 1958. Renewal Period: December 1, 1958–November 30, 1959. Meredith N. Runner. Oct. 1, 1958. 11p. Contract AT(30-1)-1762. $3.30(ph OTS); $2.40 (mf OTS).

Results are reported from an investigation of the effects of fasting on the frequency of congenital deformities in mice. (C.H.)

1880 AECU-3912

Chicago. Univ.

ANTIBODY SYNTHESIS. William H. Taliaferro. [1958]. 31p. Contract AT(11-1)-175. $6.30(ph OTS); $3.00(mf OTS).

The literature on antibody synthesis is reviewed. Present views on the induction of the immune process, the development of the antibody-forming mechanism, the incorporation of amino acids into antibody, and the diversity of antibodies are discussed. It is concluded that the immunological induction period consists of a brief period during which the immune process is induced by all or part of the antigen and a longer period involving the elaboration of the antibody-forming mechanism in the nature of cells, enzymes, RNP templates or other mechanisms. Once the antibody-forming mechanism is present, it assembles amino acids into antibody probably within a few minutes. Antibody is formed from free amino acids and not from polypeptides or protein fragments and without the intervention on long-lived amino acid–containing precursors. Antibodies of identical or closely related immunological specificity may possess markedly different biological and physico-chemical characteristics, some of which may markedly alter the primary antigen-antibody equilibrium and the secondary immunological reactions. 64 references. (C.H.)

1881 AERE-Med/R-2700

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A REPORT ON A SUGGESTED METHOD FOR THE RAPID DETERMINATION OF "THE TOTAL LEUCOCYTE COUNT." C. Sanders, R. Cox, and J. B. Sharples. Oct. 1958. 13p. $0.42(BIS).

This paper deals with our findings and experimental work carried out on a suggested rapid screening method for the detection of a leukopenia in large numbers of radiation victims as a result of atomic warfare. (auth)

1882 AMRL-366

Army Medical Research Lab., Fort Knox, Ky.

POLYPHOSPHATE METABOLISM IN X-IRRADIATED DIVISION-INHIBITED YEAST CELLS. Edward Spoerl, Della Looney, and J. E. Kazmierczak. Oct. 23, 1958. 19p. Project No. 6-59-08-014.

An increased uptake of phosphorus-32 into the insoluble polyphosphates and a decreased uptake into the soluble polyphosphates was observed in irradiated yeast cells. Observations are interpreted as the result of an inhibition of a specific use of polyphosphate in processes of cell division. (C.H.)

1883 BNL-3565

Brookhaven National Lab., Upton, N. Y.

EVIDENCE FOR NORMAL ADRENOCORTICAL FUNCTION IN TWO PATIENTS SUBJECTED TO PROLONGED SODIUM RESTRICTION. Lewis K. Dahl, Lawrence Silver, and Robert W. Christie. [Jan. 28, 1958]. 25p. $4.80(ph OTS); $2.70(mf OTS).

In two adults, a man of 49 and a woman of 73, drastic sodium restriction (115 mg/day) for periods in excess of 1 and 4 years, respectively, was associated with normal adrenocortical function, as shown by a wide variety of procedures. No evidence was found to suggest that a low salt diet might impair the organism's response to stress. (auth)

1884 HW-55117

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

STRONTIUM-90 CONCENTRATIONS IN THE HANFORD ENVIRONS. W. B. Silker. May 20, 1958. 28p. Contract W-31-109-Eng-52. $0.75(OTS).

Analysis of vegetation, soil, and animal bone samples collected from the Hanford reservation yielded average strontium-90 concentrations of 0.35 μμc/g of ash, 0.092 μμc/g of sample, and 11.2 μμc/g of Ca, respectively. No evidence was obtained to indicate significant deposition of strontium-90 from Hanford separations processes to the environs, even in the immediate vicinity of the source. The results reported revealed that strontium-90 deposition from gaseous process effluents was not measurable above the material which originated from nuclear detonations. (auth)

1885 ORO-178

Florida. Univ., Gainesville. Agricultural Experiment Station.

RECOVERY OF INDUCED MICROMUTATIONS IN OATS AND RYE BY RECURRENT SELECTION. A. T. Wallace and Fred H. Hull. [1956]. 12p. $3.30(ph OTS); $2.40(mf OTS).

The effects of ionizing radiation on the process of adaptation when intense recurrent selection is practiced were compared in oats, a self-pollinated polyploid, and rye, a cross-pollinated diploid. Applications of the findings in plant-breeding programs are discussed. (C.H.)

1886 UCRL-8237

California. Univ., Berkeley. Radiation Lab.

EFFECT OF DENSELY IONIZING RADIATIONS ON DRY PREPARATIONS OF LYSOZYME, TRYPSIN, AND DNase. Tor Brustad. Aug. 1958. 12p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The effects of beams of protons and alpha particles from the 60-inch cyclotron and beams of accelerated nuclei of helium-4, carbon-12, oxygen-16, and neon-20 from the linear accelerator on thin films of dried enzymes were measured. The experimental apparatus is described and results are presented graphically. (C.H.)

1887 UCRL-8476

California. Univ., Berkeley. Radiation Lab.

AN ULTRACENTRIFUGAL METHOD FOR THE DETERMINATION OF SERUM LIPOPROTEINS. Luigini Del Gatto, Frank T. Lindgren, and Alex V. Nichols. Sept. 29, 1958. 16p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

A convenient method was developed for the ultracentrifugal analysis of all classes of serum lipoproteins which requires a minimum of time, work, and materials. The method utilizes the principle of flotation of lipoproteins in a medium of greater density than their own hydrated density. In this procedure the isolation and the analysis of lipoproteins are done in a NaBr medium of density 1.20 g/ml. The advantages of this procedure are compared with other available methods, and its application to studies on serum lipoprotein is discussed. (auth)

1888 USNRDL-TR-270
Naval Radiological Defense Lab., San Francisco.
LATE EFFECTS OF X-RADIATION. THE INFLUENCE OF DOSE FRACTIONATION ON LIFE SPAN, LEUKEMIA, AND RENAL ARTERIOSCLEROSIS INCIDENCE IN MICE. L. J. Cole, P. C. Nowell, and J. S. Arnold. Oct. 7, 1958. 27p.

Results are reported from a study of the influence of fractionation of radiation dose on the life span and incidence of leukemia and renal arteriosclerosis in female mice exposed to various doses of x radiation. Data are tabulated. The relevance of the findings to the problem of radiation-induced ageing is discussed. (C.H.)

1889 USNRDL-TR-275
Naval Radiological Defense Lab., San Francisco.
OBSERVATIONS ON THE OXIDATION OF METHIONINE-S^{35} TO $S^{35}O_4$ AND TAURINE-S^{35} IN THE X-IRRADIATED RAT. Robert E. Kay and Cecil Entenman. Oct. 21, 1958. 19p.

The rate of oxidation of methionine by x irradiated rats was determined by determining the rates of urinary sulfate-S^{35} taurine-S^{35} excretion following an intraperitoneal injection of L-methionine-S^{35}. Increases of 34 and 37 per cent respectively, were found. The specific activity of the inorganic sulfate excreted was equal to the control value, whereas the specific activity of taurine was only 57 per cent of the control value. The rate of urinary excretion of intraperitoneally injected sodium sulfate-S^{35} was also investigated. The total activity excreted in 24 hours as sulfate-S^{35} was the same for x irradiated and unirradiated rats, whereas the specific activity of the sulfate-S^{35} excreted by the x irradiated rat was less than in sham-irradiated controls. The rate of conversion of L-methionine-S^{35} to sulfate-S^{35} and taurine-S^{35} by liver slices from x irradiated and unirradiated rats was determined and found to be unaltered by exposure to x rays. The data suggest that the excess sulfate excreted in the urine is due to an increase in methionine oxidation, whereas the bulk of the excessive taurine excreted is not. (auth)

1890 AEC-tr-3468
THE HEREDITARY INFORMATION AND ITS TRANSFORMATIONS. I. I. Schmalhausem. Translated for Oak Ridge National Lab. from Doklady Akad. Nauk S.S.S.R. 120, 187-90(1958). 8p.

Applications of the information concept to explain evolutionary transformations, and in particular the transfer mechanism of the hereditary material itself, are discussed. The concept is discussed that communication can be achieved by means of an alternation of only four signs such as a pair of bases of the desoxyribonucleic acid molecules. (C.H.)

1891 AEC-tr-3471
COMPARISON OF GENETIC EFFECT OF 31-MeV-BETATRON IRRADIATION WITH 180 KeV X-RAY IRRADIATION BY INDUCING VISIBLE RECESSIVE MUTATIONS AND GYNANDROMORPHS IN DROSOPHILA MELANOGASTER. W. Schmid. Translated for Los Alamos Scientific Lab. from Oncologia 11, 218-43(1958). 28p. (Figures Omitted)

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 11248.

1892 AEC-tr-3472
COMPARATIVE STUDIES OF THE EFFECT OF FAST ELECTRONS AND X-RAYS ON THE CORNEA OF SALAMANDER LARVAE. H. Czech, R. Czech, and H. J. Schmermund. Translated for Los Alamos Scientific Lab. from Strahlentherapie 81, 187-92(1950). 7p. (Figures Omitted).

The biological effectiveness of fast electrons and x rays on the mitotic changes of the primary effect has been tested in chromosomes. Qualitative differences between the mitotic disturbances under the influence of the two types of radiation were not observed. It could, however, be shown that the frequency of pathological changes in mitotic cells after electron irradiation is smaller per unit dose than after x-ray irradiation. The experimental results are in agreement with our ideas, based on the theory of hits, of the mechanism of action of energetic radiations on biological structures. (auth)

1893 AEC-tr-3473
COMPARISON OF THE LETHAL DOSE OF 190-KV X-RAYS AND 15 MEV ELECTRONS FOR WHOLE-BODY IRRADIATION OF RATS. G. Barth, W. Börner, G. Veith, and F. Wachsmann. Translated for Los Alamos Scientific Lab. from Strahlentherapie 92, 649-53 (1953). 7p.

The biological effects of 190-kv x radiation and 15 Mev electrons were compared in rats. Data are presented on lethal dosage and on the clinical picture and postmortem findings following exposure at various dosage levels. (C.H.)

1894 AEC-tr-3474
THE PRODUCTION OF CHROMOSOME MUTATIONS IN DROSOPHILA MELANOGASTER BY FAST ELECTRONS AND X-RAYS. G. Hohne and G. Schubert. Translated for Los Alamos Scientific Lab. from Strahlentherapie 94, 72-8(1954). 11p.

Continuing our studies of the biological effectiveness of ultrahard radiations from a 6 Mev betatron, the effects of fast electrons and 200 kv x rays in inducing chromosomal mutations in Drosophila melanogaster were determined. It was found, for the reciprocal translocations between chromosome II and III, which are amenable to detection by crossing analysis, that the rate of radiation-induced mutation increases more rapidly than in direct proportion to the dose, and may best be represented by a dosage-dependence curve with an exponent of 1.3. No difference in the effectiveness of radiations substantially differing in their differential ionization could be found; the relative effectiveness of the fast electrons is about 1. The fact that all the induced mutation rates found in this reaction were higher than those found in previous studies is attributed to the influence of the higher intensity (dose-rate) of the radiation doses now administered. (auth)

1895 AEC-tr-3475
THE EFFECT OF FAST ELECTRONS (4 MeV) AND X-RAYS (180 kV) UPON MITOSIS IN THE ROOT TIPS OF VICIA FABA. H. S. Heinrich, W. Paul, and G. Schubert. Translated for Los Alamos Scientific Lab. from Naturwissenschaften 37, 544-5(1950). 4p.

The biological effects of x radiation and electron beams were compared in chromosomes of Vicia faba root tips. Data are presented on the frequency of mitoses after irradiation with various doses. (C.H.)

1896 AEC-tr-3476

COMPARISON OF THE ACTION OF X-RAYS AND NEUTRON BEAMS IN PRODUCING CHROMOSOME BREAKS IN DROSOPHILA MELANOGASTER. K. Eberhardt. Translated for Los Alamos Scientific Lab. from Naturwissenschaften 31, 23(1943). 3p.

The biological effects of neutrons and x radiation were compared in chromosomes in Drosophila. Data are tabulated on number of chromosome aberrations induced by various dosages. (C.H.)

1897 AEC-tr-3477

COMPARISON OF THE ACTION OF X-RAYS AND FAST NEUTRONS IN PRODUCING CHROMOSOME MUTATIONS IN DROSOPHILA MELANOGASTER. A. Catsch, O. Peter, and P. Welt. Translated for Los Alamos Scientific Lab. from Naturwissenschaften 32, 23(1943). 3p.

Differences in biological effects of x radiation and neutrons were compared in chromosomes in mature spermatozoa of Drosophila. Data are tabulated on the rate of translocations produced by exposure to various radiation doses. (C.H.)

1898 AEC-tr-3478

INDUCED BREAKS OF THE X^{c2} RING CHROMOSOME OF DROSOPHILA MELANOGASTER AFTER IRRADIATION WITH X-RAYS AND FAST ELECTRONS. H. V. Brandt and W. Dittrich. Translated for Los Alamos Scientific Lab. from Strahlentherapie 91, 149-53(1953). 12p. (Figures Omitted)

Males of an X^{c2} strain of Drosophila melanogaster were irradiated with various doses of fast electrons from a 6-Mev betatron and with x-rays (180 kV). Immediately after irradiation the males were bred with Berlin normal females. The F_1 generation produced by fully-developed spermatozoa exhibited a more or less marked deficit of females, the investigations covering a total of 350,000 flies. The results were compatible with the assumption of a linear increase of the deficit of females with dosage within the dosage range investigated, from 0 to 6,000 roentgens. The x-ray experiments made it at least highly probable that the effect increases with the dose for x-rays, and the same holds true for fast electrons in the more highly scattering electron experiments. No difference in the action of the two types of rays could be found. The ring-X method is not very suitable in the form employed here for a more precise comparison of the biological activity of different types of ionizing rays. (auth)

1899 AEC-tr-3501

EFFECT OF X-RAYS AND FAST ELECTRONS ON MITOSES IN ROOT TIP CELLS OF HORDEUM. H. Bleek, W. Paul, H. J. Schermund, and G. Schubert. Translated for Los Alamos Scientific Lab. from Naturwissenschaften 36, 28-9(1949). 3p.

The biological effects of x rays and fast electrons on mitosis in chromosomes of root tip cells of sprouting barley were compared. X radiation appeared to be more effective per dose unit than fast electrons. Data are tabulated. (C.H.)

1900

THE ROENTGEN SENSITIVITY OF VARIOUS PORTIONS OF THE EYE OF YOUNG AXOLOTL (SIREDON MEXICANUM). V. V. Brunst (Roswell Park Memorial Inst., Buffalo). Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 1014-30(1958) Dec.

The comparative sensitivity to x radiation was determined for the cornea, lens, and retina of the eyes of young axolotls. Data are summarized from histological examination of 80 animals. (C.H.)

1901

THE DECAY OF X-RAY INDUCED FREE RADICALS IN PLANT SEEDS AND STARCH. Anders Ehrenberg and Lars Ehrenberg (Nobel Medical Inst., Stockholm, and Univ. of Stockholm). Arkiv Fysik 14, 133-41(1958).

The fate of the x-ray induced free radicals in living seeds and amylopectin of different water contents has been studied by means of electron spin resonance absorption. The same amount of free radicals is primarily produced in the seeds independently of their water content. The radicals remain unchanged in the driest samples but an increasing proportion of them decays as the water content increases. The initial, relatively rapid decay which is apparently second order falls to a semiconstant level that decreases very slowly. The observed growth inhibitory effects at the different water contents are found to be proportional to these semiconstant levels. The radicals induced in amylopectin are very sensitive to oxygen. The reaction in air is first order with respect to the radical concentration; its velocity increases with the water content. (auth)

1902

IMMUNOBIOLOGICAL PROPHYLAXIS AND THERAPY OF THE ACUTE RADIATION SYNDROME. K. Theurer. Atompraxis 4, 327-30(1958). (In German)

The possibility of immunobiological radiation prophylaxis and the therapy of the acute radiation syndrome based on it is discussed by means of an orientation experiment on the survival rate of pre-treated mice following wholebody x radiation. In contrast to all other procedures, immunobiological radiation prophylaxis can increase radiation tolerance in regard to the acute radiation syndrome for longer intervals of time. The mechanism can be compared with an antitoxic immunization directed against the toxic degradation products of macromolecules originating from radiation. There is a possibility that suitable vaccines can be obtained for this purpose through autolysis or hydrolysis of homologous blood. It appears to be necessary that these degradation products be completed as full antigens before being used for active immunization or for obtaining antibody serums. (auth)

1903

THE ACTION OF CHELATING COMPOUNDS ON TISSUE STORAGE AND EXCRETION FROM THE LIVING ORGANISM OF RADIOYTTRIUM, RADIOCERIUM, AND PLUTONIUM. D. I. Semenov and I. P. Tregubenko (Biophysics Lab. of Ural Branch of Academy of Sciences, USSR). Biochemistry (U.S.S.R.) 23, 55-60 (1958) Jan.-Feb.

Chelating agents, binding metal cations to form soluble, stable chelates under the conditions of the living organism, exert a pronounced effect on the radioisotope of yttrium, cerium and plutonium in the living organism. This effect is expressed in the averting of storage of the metals in the tissues and in the enhancement of the rate of excretion of the metal poisons into the urine. A comparison of the effectiveness of the various chelating ligands assignable to the group of aminopolycarboxylic acid compounds, and also those of the phosphate group,

points out substantial differences between the two groups, of both a quantitative and a qualitative nature. The ligands most effective in promoting the elimination of yttrium are uramyldiacetate and sodium ethylenediaminetetraacetate, while the most effective chelating agent acting on cerium and plutonium is hexametaphosphate. The qualitative distinctions relate chiefly to the fact that the phosphates enhance storage of yttrium and plutonium in the tissues, although, in contrast to aminopolycarboxylic acid chelating agents, they sharply reduce the accumulation of cerium in the skeleton. The data obtained attest to the fact that, aside from the stability of the compounds so formed, essential significance in determining the effectiveness of chelating agents may be assigned to the rate of the complexing process, and also to the physicochemical state of the metal in the blood stream and in the body fluids. The results cited and the conclusions drawn from them point to a possible role of bioligands occurring naturally in the living organism in mineral metabolism. The high level of effectiveness observed for hexametaphosphate with respect to cerium and plutonium is not susceptible to clinical utilization in view of the considerable toxicity of that preparation. At the same time, the effectiveness of uramyldiacetate, which exceeds that of ethylenediaminetetraacetate, and which lends itself to utilization for the treatment of heavy-metal poisoning and radioisotope poisoning, is deserving of special attention. (auth)

1904

THE EFFECT OF X-IRRADIATION ON HYPOXANTHINE BIOSYNTHESIS AND ON GLYCINE METABOLISM IN PIGEON LIVER. G. A. Kritskii (Biochemical Inst., USSR Academy of Science, Moscow). Biochemistry (U.S.S.R.) 23, 80-6(1958) Jan.-Feb.

It was shown that in liver homogenates from irradiated (2000 r) pigeons, hypoxanthine synthesis, as judged from the incorporation of glycine-1-C^{14}, was slightly increased immediately following irradiation, and greatly decreased in the following day. C^{14} incorporation from glycine-1-C^{14} into malic, succinic and fumaric acids fell sharply immediately after irradiation and remained low throughout. Radiation damage of purine biosynthesis is largely due to the inhibition of the metabolism of substrates concerned in purine biosynthesis. The high resistance to radiation of the pigeon, as compared with the majority of mammals, has been demonstrated. (auth)

1905

THE EFFECT OF X-RAYS ON THE ENZYMATIC SYSTEM OF COENZYME A OF THE PIGEON LIVER. V. N. Filippova and I. F. Seits (Leningrad Blood Transfusion Inst.). Biochemistry (U.S.S.R.) 23, 112-17 (1958) Jan.-Feb.

It was shown that, 6 to 7 days after irradiation of pigeons in doses 2 to 3 thousand r, the intensity of acetylation processes in liver homogenates fell from a mean normal value of 465 ± 16 μg sulfanilamide per g fresh tissue in 20 min to a corresponding value of 119 ± 8.5 μg. Inhibition of acetylation has also been demonstrated with other acetyl acceptors: p-aminobenzoic acid, p-aminoazobenzene, p-aminoazobenzenesulfonate and a dye obtained by coupling cresidine with acyl-H-acid. The general effect of inhibition of the acetylation system is due to the decrease in coenzyme A concentration in the liver as well as to the decrease in activity of the protein component of the system. The degree of inhibition of the enzymatic component of the acetylating system has been correlated with the severity of the radiation syndrome. The results obtained indicate that the labile link in the system, affected by the radiation, is the catalytic reaction of acetyl group transfer from coenzyme A to the acceptor, that is, the enzyme transacetylase. (auth)

1906

EFFECT OF YEAST EXTRACTS ON IRRADIATED ORGANISMS. N. V. Luchnik (Ural Branch of Academy of Sciences, USSR). Biochemistry (U.S.S.R.) 23, 139-46(1958) Jan.-Feb.

Yeast extracts have the property of decreasing the harmful effect of radiation on the living organism. They differ advantageously from most other anti-irradiation remedies in effectiveness upon use after irradiation and in a lack of species specificity characteristic of other tissue preparations which are effective after irradiation, such as spleen and bone marrow. In tests with mice, yeast extracts increase LD_{50} by about 100 r. In tests on pea sprouts they lower the percent of pathological mitoses several times and decrease the depression of plant growth brought about by irradiation. Not all yeast extracts have the same effectiveness. The conditions of storage of the yeast before preparation of their extracts are factors of considerable importance determining their effectiveness. The most effective extracts are obtained following action of various agents injurious to the yeast (cold, drying, irradiation) in which the optimal conditions are those which depress but do not halt living processes (thus cooling to low positive temperatures gives better effects than freezing: irradiation with 5000 r a better effect than 25,000 r). The effective source in yeast extracts is RNA or its derivatives. Water soluble vitamins, amino acids, and proteins do not play a significant role. The effectiveness of yeast extracts is correlated with their phosphorus content. RNA, both separated from yeast extracts and obtained preparatively, has the same effect as yeast extract; however, some RNA preparations are ineffective. The hypothesis is formulated that radiation damage to nucleoprotein metabolism can be decreased by the introduction either of specific nucleic acids or of depolymerized nucleic acids which have lost their species specificity, while denatured or foreign polymerized nucleic acids have no effect. In such cases the results described are in accordance with data as to the anti-irradiation effect of spleen and bone marrow preparations. (auth)

1907

INCREASED RESISTANCE OF ANIMALS TO X-RAY IRRADIATION FOLLOWING A PERIOD OF ACCLIMATIZATION TO HYPOXIA IN THE PRESENCE OF A NORMAL BAROMETRIC PRESSURE. G. A. Vasil'ev. Bull. Exptl. Biol. Med. (U.S.S.R.) (English Translation) 45, 175-8(1958) Feb.

It was established as a result of experiment that the endurance of white mice to irradiation by x-rays is increased under the effect of acclimatization to hypoxia without decrease of barometric pressure. The activity of catalase in the blood and organs of acclimatized animals is increased. (auth)

1908

RESULTS OF LOCALIZED IRRADIATIONS OF THE TIPS OF THE ANTERIOR LIMBS IN THE BIRD EMBRYO. Et. Wolff and M. Kieny (College de France

et C.N.R.S., Paris). Compt. rend. soc. biol. 152, 712-14(1958). (In French)

The x irradiation of the tips of the anterior limbs of the bird embryo 3 to 3½ days after incubation causes the atrophy of the limbs of which certain bony parts disappear first: I and III fingers for the autopode and the radius for the zeugopode. The pieces which last the longest are the middle finger of the autopode, the cubitus, and the humerus. It appears that these bones use the material reduced by the radiation to the detriment of the others. (tr-auth)

1909

TREATMENT OF CEREBRAL TUMORS BY SLOW NEUTRONS. Eduardo Ramos. Energia nuclear (Madrid) 1, 33-42(1957) Jan.-Mar.

A survey is presented of the treatment of cerebral tumors with x radiation, radiation from various radioisotopes, and slow neutrons. The emphasis is placed on slow neutron treatment, and the medical facilities used for this treatment are described. 48 references. (J.S.R.)

1910

RADIOACTIVE STRONTIUM IN BIOLOGY. Margarita Celma Villares. Energia nuclear (Madrid) 2, No. 6, 34-42(1958) Apr.-June. (In Spanish)

A summary is presented of the Sr^{90} content of soil, vegetation, milk, animal bones, and human bones throughout the world. 14 references.

1911

RADIATION DAMAGE IN THE DEVELOPING GERM CELLS OF DROSOPHILA VIRILIS FROM FAST NEUTRON TREATMENT. Mary L. Alexander (Univ. of Texas, Austin and Brookhaven National Lab., Upton, N. Y.). Genetics 43, 458-69(1958) July.

The radiation damage produced by the densely ionizing radiations from fission neutrons was tested by studies of various stages of post- and premeiotic germ cells of Drosophila virilis. Young males were treated with doses of 600, 1200, and 2400×10^8 n^f/cm^2 and the various types of cells sampled by successive remating periods. The induction of translocations and dominant lethals in the various stages of spermatogenesis was tested. Translocation and dominant lethal damage produced from neutron treatment in the immature germ cells increased proportionally with an increase in dose. The damage obtained for each type of cell in the spermatogenic cycle resulted in a curve which would be expected when multiple chromosome breakage is produced from a single proton hit. The radiation damage increased linearly with dose in the various types of cells although the relative sensitivity of the various stages was not the same. Postmeiotic germ cells (B-D) varied in sensitivity to chromosome breakage with the sensitivity peak occurring in the spermatozoa sampled 13-15 days after treatment (Period D). A neutron dose of 1.5 to 2 times greater is required to produce the same amount of radiation damage in the more mature type of cells (B) as with the D types. Cells treated in meiotic and premeiotic stages contained fewer translocations and lower percentages of dominant lethals than postmeiotic cells. The reduction in the number of spermatozoa in the treated males in mating period G indicates that some types of spermatogonial germ cells degenerate as a result of neutron irradiation. The relative biological efficiency of fission neutrons and 200 kv x rays differ in mature sperm, spermatids and meiotic cells. Fission neutrons are at least six times more effective than x ray in mature sperm; in spermatids, the difference is only two to three times larger for neutrons. In meiotic cells fission neutrons are only 1.6 times more efficient. (auth)

1912

AN ANALYSIS OF DATA FROM LABORATORY POPULATIONS OF DROSOPHILA MELANOGASTER. E. Novitski and E. R. Dempster (Oak Ridge National Lab., Tenn. and Univ. of California, Berkeley). Genetics 43, 470-9(1958) July.

In some cases heterosis is inferred because a population appears to contain more heterozygotes than can be accounted for by ordinary genetic theory. A mathematical model based on a maximum likelihood formulation has been set up that allows an estimate to be made of the degree to which irregularities in genetic data require the assumption of heterosis. The analysis based on such a model is not practicable by ordinary methods, and for this reason an automatic computer (the Oracle at the Oak Ridge National Laboratory) was used. The output of the computer showed that the assumption that heterosis is responsible for the increased frequency of the heterozygotes is unwarranted, and that a reduced viability of homozygous classes will equally well explain such data. This result is of some interest because it shows that one of the most commonly applied tests for heterosis, a statistical test for an excess of heterozygotes in a population, is actually ambiguous even if the data should consist of a large number of replicated trials or observations. (auth)

1913

THE DOSAGE RESPONSE CURVE FOR RADIATION INDUCED DOMINANT LETHAL MUTATIONS IN THE HONEYBEE. William R. Lee (Univ. of Wisconsin, Madison). Genetics 43, 480-92(1958) July.

The dosage of gamma radiation required to inactivate honeybee sperm is several fold higher than the nearly 100 percent dominant lethal dosage, as in Habrobracon. Nearly all the induced dominant lethals caused death in the egg stage. The proportion of dominant lethals in irradiated spermatozoa did not change after one year of storage in the spermatheca of the queen. There was no significant fractionation effect, the percentage of dominant lethals being the same when 2,000 r were given in a continuous dose as when given in two equal fractions separated by one hour. The curve relating dominant lethals to dosages is in quantitative agreement with those of Drosophila and Habrobracon. It shows a highly significant departure from linearity (after correction for natural mortality and saturation), but approaches linearity at low dosages. This is consistent with the hypothesis that dominant lethals are due primarily to single chromosome breaks at low dosages and multiple break phenomena at higher dosages. (auth)

1914

MODIFICATION OF CHROMOSOMAL ABERRATION YIELD BY POSTIRRADIATION TREATMENT. Sheldon Wolff and H. E. Luippold (Oak Ridge National Lab., Tenn.). Genetics 43, 493-501(1958) July.

In Tradescantia microspores, postirradiation treatments can modify the numbers of chromosome exchanges induced by x rays. The postirradiation inhibition of respiration by anoxia or carbon monoxide in the dark prevents the rejoining of breaks and consequently allows breaks to remain open and capable of forming exchanges with breaks induced later. The results with Tradescantia are qualitatively similar to the results ob-

tained with Vicia in that irradiation in the presence of oxygen produces more breaks than does anoxic irradiation and that for rejoining cellular respiration (the production of ATP) is required. (auth)

1915

THE MEIOTIC BEHAVIOR OF GROSSLY DELETED X CHROMOSOMES IN DROSOPHILA MELANOGASTER. Dan L. Lindsley and L. Sandler (Oak Ridge National Lab., Tenn.). Genetics 43, 547-63(1958) July.

The disjunction of a series of X chromosome deletions (constructed by deleting, with x irradiation, all but a negligible amount of the euchromatin of the X and a variable amount of the proximal heterochromatin) was studied in X/X/Del females, attached-X/Del females, and attached-XY/Del males. With one interesting exception, the data agree with the notions of Gershenson. The exception was found in the results from matings of males carrying the attached XY chromosome and certain of the deletions. Among their progeny the deletion is recovered in considerably more than half of the individuals whereas the XY is recovered in considerably less than half. The following points have been established: Egg counts have shown that this is not zygote mortality. The fact that the deletions are recovered in excess of 50 percent of the progeny eliminates meiotic chromosome loss as the explanation of the discrepancy. Evidence is presented indicating an autosomal influence on this phenomenon. Finally, it has not yet been possible to determine the physical basis of these results. However, it appears that whatever the physical basis, this phenomenon could cause meiotic drive in a population. (auth)

1916

EFFECTS OF X-RAY RADIATION ON OAT SEED. R. Abrams. J. Agr. Puerto Rico 41, 242-58(1957).

Studies with six varieties showed that recurrent irradiation of oat seed in successive generations tended to increase their sensitivity to x radiation treatment when measured by number of seed killed. Varietal differences in susceptibility to radiation damage were observed. (C.H.)

1917

A COMPARISON OF THE EFFECTS ON THE SHWARTZMAN PHENOMENON OF LEUKOPENIA PRODUCED BY NITROGEN MUSTARD AND BY WHOLE BODY IRRADIATION. Douglas E. Johnstone and Joe W. Howland (Univ. of Rochester School of Medicine and Dentistry, N. Y.). J. Exptl. Med. 108, 431-40(1958) Oct. 1.

The effect of leukopenia on the susceptibility of rabbits to the localized Shwartzman reaction was studied in those receiving whole-body irradiation and nitrogen mustard respectively. Of animals receiving nitrogen mustard in which the total polymorphonuclear leukocyte count was less than 100 cells/cmm only 17 per cent developed positive local Shwartzman reactions whereas 75 per cent of irradiated animals with total polymorphonuclear leukocyte counts less than 100 cells/cmm had positive reactions. A local Shwartzman reaction occurred in 60 of 71 control rabbits (85 per cent). Animals of both the treated groups showed positive Shwartzman reactions at a time when their total polymorphonuclear leukocyte counts were less than 500 cells/cmm. From the findings, it is concluded that the presence of normal numbers of circulating polymorphonuclear leukocytes is not an obligatory prerequisite condition to the localized hemorrhagic necrosis of the Shwartzman phenomenon, and the mechanisms of action of nitrogen mustard and whole-body irradiation on body tissues differ in relation to the Shwartzman reaction. (auth)

1918

X-IRRADIATION OF THE GIANT AMOEBA, PELOMYXA ILLINOISENSIS. II. FURTHER STUDIES ON RECOVERY FOLLOWING SUPRALETHAL EXPOSURE. Edward W. Daniels (Argonne National Lab., Lemont, Ill.). J. Exptl. Zool. 137, No. 3, 425-40(1958) Apr.

Living, nonirradiated, centrifuged giant amoebae were separated into light and heavy halves which were then injected by fusion into different supralethally x-irradiated cells. Heavy, centrifugal portions of cells centrifuged for 10 minutes at forces which ranged from 700 g to 30,000 g brought about recovery from supralethal x-ray injury. These heavy portions contained the nuclei and most of the mitochondria. The percentage of light halves capable of preventing death after fusion decreased in a linear manner from the 92% produced by noncentrifuged, nonirradiated whole protoplasm to some 3% produced by light halves centrifuged at 5000 g. Light halves of cells centrifuged at forces greater than this were even less capable of preventing death. The nonirradiated nuclei do not appear to be required by the lethally irradiated cell for recovery providing nonirradiated cytoplasm is present. Exposed nuclei recover and divide repeatedly after fusion. The need of lethally irradiated cells for nonirradiated mitochondria appears to be negligible. Cell division occurred at normal time intervals in the irradiated cells which received nonirradiated heavy halves. Many of the light halves centrifuged at the lower forces also produced this result. The 0.1 to 0.3 μ particulates which do not stain with acid-fuchsin, and/or the cytoplasm which contains them, appear to have the capacity to prevent death in supralethally x-irradiated organisms. The migration of these particulates out of the light portions into the heavy portions during centrifugation is closely correlated with the loss in therapeutic value of the light portions. (auth)

1919

LIMITATION OF RADIOIODINE AS A LABEL FOR FAT. E. Van Handel and D. B. Zilversmit (Univ. of Tennessee, Memphis). J. Lab. Clin. Med. 52, 831-9(1958) Dec.

Chemical procedures for the determination of I^{131} lipid fractions in whole blood, plasma, and tissues are discussed. I^{131}-labeled triolein, administered intravenously as an emulsion, disappears at the same rate as natural fats. After oral administration of I^{131} triolein the concentration of I^{131} triglyceride in dog plasma during the period of alimentary lipemia is lower than that of the chemically determined fat. This difference between the specific activity of fed fat and plasma fat already exists in lymph, as shown by the low specific activity of dog and rat lymph compared to that of the administered fat. Comparison of I^{131} and C^{14} triolein showed that dilution by an endogenous triglyceride pool cannot account for the observed decrease in specific activity. The distribution of orally administered C^{14} oleic acid and C^{14} stearic acid in the neutral fat fraction of carcass is fairly similar to that of I^{131} oleic acid. However, in liver, where rapid incorporation of C^{14}-labeled fatty acids into phospholipid fractions occurs, I^{131} oleic acid was found to be absent and thus gives an erroneous picture of the distribution of dietary fatty acids. (auth)

1920

THE DISTRIBUTION OF RADIOACTIVITY IN THE RABBIT AFTER INHALATION OF METHYL RADIO-

IODIDE OR INJECTION OF SODIUM RADIOIODIDE. G. Debus, P. F. Nace, L. Donato, J. Moule, and L. R. Murrell (McMaster Univ., Hamilton, Ont., Can.). Minerva nucleare 2, 221-3(1958) Sept. (In Italian)

Measurement of the left ventricular stroke and the residual volumes by inhalation radiocardiography, and applications of these determinations to the diagnosis of congenital and acquired heart lesions were described in a recent report of this research group. The present report offers evidence of the origin of the terminal portion of the inhalation curve. This was obtained by treatment of rabbits with radioiodine compounds, by inhalation and intravenous injection. In animals sacrificed a few seconds to 3 hours after administration of tracer, the activity of the myocardium exceeded that of the trachea. Liver, intestine, and kidney reached maximum activity somewhat later than the heart, trachea, lung, and brain. The excretion in the urine of a substantial portion of the inhaled radioactivity was established. The major findings support the earlier interpretation of the terminal portion of the human inhalation radiocardiogram as a consequence of persistent radioactivity in the myocardium. The application of this localization to measurement of coronary circulation is considered. (auth)

1921

THE USE OF SURFACE DIRECTIONAL COUNTING IN THE DETERMINATION OF THE RADIOACTIVITY AFTER TAGGING THE RED BLOOD CELLS WITH CHROMIUM-51. I. Pannacciulli and A. Tizianello (Univ. of Genoa). Minerva nucleare 2, 223-7(1958) Sept. (In Italian)

The surface directional counting method was tested by comparison of the blood and precordial radioactivity, using Cr^{51}-labelled red blood cells. A satisfactory correlation was found. Limits and usefulness of the surface directional methods are discussed as a complement to the determination of the erythrocyte survival and to spleen and liver uptake studies. (auth)

1922

INITIAL RESULTS ON THE MORPHOLOGICAL AND HISTOCHEMICAL INVESTIGATION ON THE LIVER OF THE WHOLE-BODY IRRADIATED RAT PROTECTED WITH CYSTEAMINE. Z. Fumagalli, M. Lupo, and G. Pisani (Istituto Radiologico dell'Ospedale Maggiore, Novara, Italy and Univ. of Messina, Italy). Minerva nucleare 2, 238-44(1958) Sept. (In Italian)

The structure of the condrioma, the alkaline fosfomonoesterase activity, and the glycogen and ascorbic acid content of the liver of irradiated rats protected and non-protected with cysteamine were investigated. (auth)

1923

FAILUTE TO INDUCE IMMUNOLOGICAL TOLERANCE DURING RECOVERY FROM IRRADIATION. G. J. V. Nossal and Lois Larkin (Walter and Eliza Hall Inst. of Medical Research, Melbourne). Nature 182, 1147-8 (1958) Nov. 22.

Experiments were conducted to induce immunological tolerance in irradiated adult and immature mice by injections of isologous bone marrow and rat erythrocytes. No immunological tolerance resulted from these experiments. Attempts were made to save lethally irradiated adult mice with grafts of embryonic hemapoietic tissue and to induce tolerance in this grafted tissue by antigenic stimulation. The use of embryonic liver to save lethally irradiated animals was unsuccessful. (J.H.M.)

1924

FALL-OUT RADIOACTIVITY IN A DEER'S ANTLERS. J. Hawthorn and R. B. Duckworth (Royal Coll. of Science and Tech., Glasgow). Nature 182, 1294(1958) Nov. 8.

The rapidity with which antlers of deer are formed coupled with the fact that these animals normally graze on upland pastures which are known to contain relatively high levels of fall-out radioactivity suggested that antlers might show heavy contamination with radiostrontium. A pair of antlers from a deer shot on the island of Islay, Nov. 3, 1957, was assayed for radioactivity. The activity (Sr^{89} and Sr^{90}) was found to be 126 $\mu\mu c/g$ of calcium present. The same tests were made on a sample of antlers from the same area taken in 1952, and the activity was found to be 11.2 $\mu\mu c/g$ of calcium. (A.C.)

1925

ACCUMULATION OF STRONTIUM-90 IN DENTAL TISSUES. W. Holgate (Royal Naval Medical School, Alverstoke); R. H. Mole (Medical Research Council, Harwell, Eng.); and Janet Vaughan (Churchill Hospital, Oxford). Nature 182, 1294-5(1958) Nov. 8.

Weanling rabbits given single injections of 500 to 1,000 μc of Sr^{90} per kg showed a high frequency of tumors of the jaw, and preliminary histological studies indicate that they arose in close relation to the teeth. The results of the investigation are tabulated. (A.C.)

1926

ADVANCES IN THE USE OF RADIOISOTOPES. MEDICAL USES. W. S. Eastwood. Nature 182, 1407-9(1958) Nov. 22.

Recent developments in the medical and general uses of radioisotopes that were presented at the 2nd Geneva Conference are reviewed. Discussions are included on: the use of tritium in biochemical work; applications to the central nervous system; the use of P^{32}, Ca^{45}, and S^{35} following the metabolic processes of healing fractures; radioiodine uses; diagnostic uses; therapeutic uses; and other isotope applications. (J.H.M.)

1927

INTRODUCTION OF RADIOACTIVE SOLUTIONS INTO TREES AND SHRUBS. R. P. Ealy. Oklahoma Agr. Expt. Sta. Tech. Publ. No. 70, (1957). 4p.

A technique is described for introducing radioactive solutions into the tap root of young trees and shrubs. (C.H.)

1928

MEASUREMENT OF THORON IN THE BREATH. J. Rundo, A. H. Ward, and P. G. Jensen (Finsen Lab., Copenhagen). Phys. in Med. and Biol. 3, 101-10(1958) Oct.

A method of measuring the thoron content of the breath of patients who have been injected with colloidal thorium dioxide as a radiological contrast medium, is described. The levels are sufficiently high for the decay of the thoron to be observed using only four liters of breath, being in the range 250 to 2000 $\mu\mu c$ per liter, and they can be used to estimate the volumes of colloid injected many years previously. It is also shown that not more than about 10% of the thoron produced in the liver and spleen (the organs containing the major part of the thorium) is exhaled. The average radiation dose-rates to the lung are estimated to be in the region of 0.3 rem per week (R.B.E. for α particles assumed to be 10), but the dose-rates to the bronchus and trachea are 10 to 15 times as great. A patient in-

jected with 75 ml colloidal thorium dioxide may thus receive a cumulative dose to the bronchus of about 1000 rads in 16 years. (auth)

1929

HISTOMETRIC EVALUATION OF THE CONNECTIVE TISSUE AFTER X IRRADIATION. A. Romanini, S. Chiappa, and L. Roncoroni (Univ. of Milan). Radiobiologica Latina 1, 1-14(1958) Jan.-Mar. (In Italian)

The modifications which take place in the connective tissue after exposure to ionizing radiations were studied. Exposed skin and skin which was well protected from the radiations were examined. Histometric examination disclosed consensual modifications of the connective tissue which, of course, were greater in the irradiated skin. Edema of the connective tissue was first observed, followed by an increase of the number of the mastcells, then an increase of the connective tissue, and lastly a fibrous modification of the connective tissue. During the last phases of these modifications, the number of the mastcells progressively decreases. (auth)

1930

HISTOCHEMICAL INVESTIGATION OF THE VARIATION OF THE GLYCOGEN CONTENT OF THE LIVER OF RATS EXPOSED TO A FATAL DOSE OF WHOLE-BODY X RADIATION. Pietro Bronzetti and Giovanni Lo Sardo (Univ. of Messina, Italy and Istituto Radiologico dell'Ospedale Maggiore, Novara, Italy). Radiobiologica Latina 1, 15-27(1958) Jan.-Mar. (In Italian)

The behavior of the glycogen content of the liver of rats irradiated with a lethal dose of x rays (800 r) over the whole body was studied by a histochemical method. One hour after irradiation glycogenolysis takes place. This phenomenon increases after two hours and remains on this level as long as 24 hours after irradiation. Then glycogenosynthesis is resumed by liver cells and after 96 hours the glycogen content of the liver is practically restored to normal. Later (after 168 hours) glycogenolysis develops, histologically appearing similar to that of the first hours after irradiation. (auth)

1931

THE EFFECT OF CYSTEAMINE, A RADIOPROTECTOR, ON THE VARIATION OF THE HEPATIC GLYCOGEN OF THE RAT AFTER WHOLE-BODY IRRADIATION WITH A MORTAL DOSE (HISTOCHEMICAL INVESTIGATION). Paolo Fumagalli and Adalberto Malaspina (Univ. of Messina, Italy and Istituto Radiologico dell'Ospedale Maggiore, Navara, Italy). Radiobiologica Latina 1, 28-39(1958) Jan.-Mar. (In Italian)

The behavior of the glycogen content of the liver of rats treated with cysteamine (10 mg/100 gr of body weight) and of rats totally irradiated with a lethal dose of x rays (800 r) after the administration of a protective dose of cysteamine was studied. It was demonstrated that cysteamine determines glycogenolysis which is particularly evident two hours after treatment. The glycogen content of the liver is restored to normal after 24 hours. In totally irradiated animals receiving a protective dose of cysteamine, in the first hours after irradiation a marked glycogenolysis takes place, followed by glycogeno-synthesis, well evident 24 hours after irradiation, which restores to normal the glycogen content of the liver. (auth)

1932

THE BEHAVIOR OF THE ALKALINE PHOSPHATASE ACTIVITY OF THE LIVER OF THE RAT AFTER WHOLE-BODY X IRRADIATION WITH A LETHAL DOSE. Finocchio Francesco and Malaspina Adalberto (Univ. of Messina, Italy and Istituto Radiologico dell' Ospedale Maggiore, Novara, Italy). Radiobiologica Latina 1, 40-53(1958) Jan.-Mar. (In Italian)

The modification of the enzyme activity of the rat liver during the first 168 hours after a single irradiation of 800 r over the whole body was studied. Gomori's method for alkaline phosphatase with different periods of incubation was used and the following results were obtained: The alkaline phosphatase activity augments in the endothelial cells of intralobular capillaries during the first days after irradiation, while it disappears for a few days, returning on the seventh day to its normal activity. The alkaline phosphatase activity diminishes in the nucleus of liver cells and in bile capillaries, completely disappearing about the fourth day after irradiation. It is still absent on the seventh day after irradiation. The alkaline phosphatase activity of the connective tissue of interlobular spaces and of the reticular fibers of the outer part of the liver lobules is markedly reduced and persists only in the adventitia of small bile ducts. (auth)

1933

THE BEHAVIOR OF THE ALKALINE PHOSPHATASE ACTIVITY OF THE LIVER OF THE RAT WHOLE-BODY X IRRADIATED AND PROTECTED WITH CYSTEAMINE. Fumagalli Paolo and Malaspina Adalberto (Univ. of Messina, Italy and Istituto Radiologico dell'Ospedale Maggiore, Novara, Italy). Radiobiologica Latina 1, 54-69(1958) Jan.-Mar. (In Italian)

By means of Gomori's method for the demonstration of alkaline phosphatase, the behavior of the enzyme activity of the liver of rats treated with cysteamine and of rats totally irradiated with 800 r after the administration of a protective dose of cysteamine was studied. The alkaline phosphatase activity increased in the liver cells of rats treated with cysteamine and also in Kupffer cells, which were present in great number. The alkaline phosphatase activity of the liver cells of rats irradiated after the administration of a protective dose of cysteamine did not differ from that of controls. In the liver of these rats during the first hours after irradiation numerous endothelial cells were present giving an intense reaction. Later, as in rats treated only with cysteamine, numerous cells appear, similar to Kupffer cells, which are remarkably blackened by the cobalt sulfide. (auth)

1934

HISTOLOGICAL INVESTIGATION OF THE BEHAVIOR OF THE LIVER MITOCHONDRIA OF THE RAT WHOLE-BODY X IRRADIATED WITH A LETHAL DOSE. Pietro Bronzetti and Adalberto Malaspina (Univ. of Messina, Italy and Istituto Radiologico dell'Ospedale Maggiore, Novara, Italy). Radiobiologica Latina 1, 70-87(1958) Jan.-Mar. (In Italian)

It was demonstrated that irradiation of the whole body of rats with a lethal dose of x rays (800 r) produces a reversible modification of the liver cell mitochondria. At first mitochondria are reduced in number and lose their affinity for iron, then (24 hours after irradiation) they are transformed in granules and react again with iron. About the seventh day after irradiation, mitochondria of all liver cells of every lobule return to their normal condition. The loss of affinity for iron of mitochondria is discussed as it is considered. The morphological result of the modifications of the enzymes related to mitochondria determined by the action of x rays. (auth)

1935
THE HEPATIC MITOCHONDRIA OF THE RAT TREATED WITH CYSTEAMINE AND WHOLE-BODY X IRRADIATED WITH A LETHAL DOSE. Candido Armellini, Paolo Fumagalli, and Giovanni Pisani (Univ. of Messina, Italy and Istituto Radiologico dell'Ospedale Maggiore, Novara, Italy). Radiobiologica Latina 1, 88-108(1958) Jan.-Mar. (In Italian)

The behavior of the mitochondria of liver cells of rats treated with cysteamine (10 mg/100 gr of body weight) and of rats treated with a lethal dose of x rays (800 r) over the whole body after having received a protective dose of cysteamine was studied. In both cases quantitative and reversible modifications of mitochrondria were observed. The modifications determined by cysteamine disappear about 24 hours after the administration of this drug, while the modifications induced by x rays disappear sooner when the animals receive also cysteamine in comparison with unprotected rats. (auth)

1936
RADIOPROTECTIVE EFFICIENCY OF CYSTEAMINE DERIVATIVES. F. Bonati and U. Nuvolone (Cancerologia sperimentale Ospedale Maggiore, Novara, Italy and Laboratori Ricerche Braco, Milan). Radiobiologica Latina 1, 162-70(1958) Apr.-June. (In Italian)

The protective qualities of a series of cysteamine derivatives against ionizing radiations were investigated. In doses of the same degree of toxicity, cysteaminemonoacetic acid and glutamylcysteamine are just as effective as cysteamine. Gluconylcysteamine, even if quite active, is less so compared to cysteamine. Methioninamine has a sensitizing effect. These results are discussed in relation to the general formula proposed by Langedorff et al. for the radioprotective cysteamine derivatives and also in relation to the importance of the amino group in anti-x protection. (auth)

1937
HISTO-VOLUMETRIC ALTERATIONS OF THE EXOCRINE PANCREATIC TISSUE EXPOSED TO X RADIATION. Luigi Roncoroni (Univ. of Milan). Radiobiologica Latina 1, 179-84(1958) Apr.-June. (In Italian)

The modifications induced by radiation on the exocrine pancreatic tissue are examined. These investigations have shown that in a first phase intercellular edema is manifest, while in a second phase a decrease of the pyrrolinophil cytoplasmatic components and a considerable increase of the nuclear volume, ascribable to nuclear swelling, is observed. (auth)

1938
THE HEPATIC REGENERATION OF THE RAT AFTER HEPATECTOMY AND EXPOSURE TO Co^{60} RADIATION. M. Sforza and M. Vaccheri (Univ. of Milan). Radiobiologica Latina 1, 192-6(1958) Apr.-June. (In Italian)

The effects of liver extracts, vitamin B_{12}, thioctic acid, and lambrathene, administered orally and intraperitoneally, were observed on the liver regeneration of white rats after 60% hepatectomy and on the serum proteins after whole-body Co^{60} irradiation. Some hypotheses are suggested to explain the phenomena observed. (auth)

1939
HEPATIC REGENERATION, THE HEMATIC PICTURE, AND SERUM PROTEINS IN THE RAT EXPOSED TO Co^{60} RADIATION OF DIFFERENT DOSES. M. Sforza and M. Vaccheri (Univ. of Milan). Radiobiologica Latina 1, 185-91(1958) Apr.-June. (In Italian)

Investigations were made on rats submitted to a hepatectomy and whole-body Co^{60} irradiation. The liver regeneration was measured by weight changes, and the serum albumin and globulin concentrations were determined. It was shown that radiation causes, after a lapse of time, a decrease in the regenerative activity of the liver and an alteration of the serum proteins which is difficult to interpret. (auth)

1940
INVESTIGATIONS ON THE SERUM PROTEINS OF THE RABBIT EXPOSED TO WHOLE-BODY Co^{60} RADIATION. M. Sforza, M. Vaccheri, and C. Mangioni (Univ. of Milan). Radiobiologica Latina 1, 197-200(1958) Apr.-June. (In Italian)

An investigation was made on the serum proteins and on the blood picture of rabbits radiated with Co^{60} at doses of 200, 400, and 600 r. The results obtained are reported, and further investigations are suggested for the purpose of studying the meaning and importance of the results obtained. (auth)

1941
ANGIOGRAPHY IN ACUTE RADIATION SICKNESS. K. B. Tikhonov (State Research Inst. of Roentgenology and Radiology, Ministry of Health, USSR). Vestnik Rentgenol. i Radiol. 33, No. 4, 60-3(1958) July-Aug. (In Russian)

The author has carried out a roentgenological study of the blood vessels of the pelvis, extremities, and abdominal internal organs on 21 dogs and 26 rabbits. The majority of experiments on dogs were performed under general anesthesia. In the study of extremities the contrast media were injected into the femoral artery by the retrograde method. The vessels of internal organs were filled with contrast medium by translumbar puncture of abdominal aorta (in dogs), or by injection into the pulmonary circulation (in rabbits). The angiograms were taken with the aid of a special apparatus designed by the author. Considerable increase of permeability of the blood vessels for contrast media was noted during the acute stage of radiation sickness. During that period the lumen of the arteries of extremities and pelvis was found to be greatly constricted, while that of the main arteries of abdominal cavity was, on the contrary, dilated. This dilatation was most pronounced in rabbits. (tr-auth)

1942
TISSUE TRANSPLANTATION IN RADIATION LEUKOPENIA. K. N. Chochia (Central Research Inst. of Roentgenology and Radiology). Vestnik Rentgenol. i Radiol. 33, No. 4, 79-80(1958) July-Aug. (In Russian)

1943
THE CONDITION OF BONE MARROW AND PERIPHERAL BLOOD IN RADIUM THERAPY OF MALIGNANT NEOPLASMS. N. E. Chogoshvili, T. I. Nechaeva, and Z. G. Ishchenko (State Research Inst. of Roentgenology and Radiology, Ministry of Health USSR). Vestnik Rentgenol. i Radiol. 33, No. 4, 84-6(1958) July-Aug. (In Russian)

1944
THE PRACTICE OF NUCLEAR MEDICINE. William H. Blahd, Franz K. Bauer, and Benedict Cassen. Springfield, Ill., Charles C Thomas, 1958. 424p.

Recent developments in the applications of nuclear radiations in medical diagnosis, therapy, and research are reviewed. Radioisotopes have been used as analytical tools in investigating the complex biochemical

activity of the human body. Hundreds of isotope-labeled compounds have been used. Diagnostic procedures currently in use include physiologic localizations, dilution techniques, flow or diffusion measurements, and studies of organic metabolites. Present therapeutic uses of radioisotopes are discussed. Biochemical placement achieved by selective absorption of a material needed by a particular tissue or by differential turnover, physical placement of radioactive materials, and teletherapy employing a gamma-ray beam from a concentrated radioisotope source are described. (C.H.)

1945

A DIRECTORY OF MEDICAL AND BIOLOGICAL RESEARCH INSTITUTES OF THE USSR. Public Health Service Publication No. 587. David P. Gelfand, comp. Washington, U. S. Department of Health, Education, and Welfare, 1958. 345p.

Over 700 USSR medical and biological research institutes are listed, with their subdivisions. A general subject index and a name index are included. (C.H.)

1946

RADIOLOGICAL PHYSICS. M. E. J. Young. New York, Academic Press Inc., 1957. 373p.

Fundamental concepts of nuclear theory are reviewed. Topics discussed include the production of x rays, naturally-occurring radioactive substances and their uses as sources of ionizing radiation, the interaction of x and gamma radiation with matter, the measurement of ionizing radiations, principles of diagnostic radiography, chemical and biological effects of ionizing radiations, therapeutic uses of x and gamma radiation, medical applications of radioactive isotopes, and health hazards and radiological protection. (C.H.)

CHEMISTRY

General

Refer also to abstract 2610.

1947 AECU-3875

Case Inst. of Tech., Cleveland.

A CALCULATION OF THE ELASTIC CONSTANTS OF CALCIUM FLUORIDE (thesis). Technical Report No. 1. Robert N. Seitz. May 1958. 35p. Contract AT(11-1)-623. $6.30(ph OTS); $3.00(mf OTS).

The electrostatic contributions to the elastic shear constants $\frac{1}{2}(c_{11}-c_{12})$, c_{44}, and the bulk modulus are calculated for calcium fluoride, assuming a Coulomb attractive force. Born-Mayer theory was first used to evaluate the repulsive energy contribution to the elastic constants, and the theoretically-determined values were compared with experiment. However, since this procedure led to poor agreement with the experimental data, the repulsive energies were modified; the exponential form was retained, but the parameters were adjusted in such a way as to bring the calculated elastic constant values into agreement with the experimental values. The adjusted values were: A_{+-} = 2.818 times the Born-Mayer value = 7.41×10^{-11} ergs, A_{--} = 0.372 times the Born-Mayer value = 1.42×10^{-11} ergs, and ρ = 0.870 times the Born-Mayer value = 0.300×10^{-8} cms. It is concluded that the parameters found by Born and Mayer for the alkali halides are not applicable. (auth)

1948 AFOSR-TN-58-803

Pomona Coll., Claremont, Calif.

HIGH RESOLUTION MICRORADIOGRAPHY. Technical Report No. 2. Burton L. Henke. Sept. 1958. 67p. Contract AF-49(638)-394. (AD-202236).

The requirement of ultrasoft x radiation (10 to 100 A) for high-resolution microradiographic analysis is established. Optimum methods are described for obtaining structure, mass distribution, and mass-chemical information for microscopic sample regions as small as a few square microns and for total mass as small as a few micro-micrograms. The details of the techniques and of the instrumentation which are used in high-resolution microradiographic analysis are presented. (auth)

1949 AFOSR-TN-58-940

Johns Hopkins Univ., Baltimore.

KINETICS OF THE EXCHANGE OF DEUTERIUM BETWEEN DIBORANE AND TETRABORANE. J. E. Todd and W. S. Koski. Oct. 1958. 24p. Contract AF18(600)-1526. (AD-205086).

The kinetics of the exchange of deuterium between diborane and tetraborane have been found to be complex. The results indicate that the exchange proceeds by two different paths, one involves two hydrogen positions in tetraborane and the other involves the remaining eight or all ten hydrogen positions. The major reaction is interpreted in terms of a rate-determining reaction of BD_3 from diborane with B_4H_{10} while the minor reaction is envisaged as a rate-determining activation of two sites in tetraborane followed by rapid deuterium exchange with B_2D_6. Boron atoms also exchange in this system although detailed kinetics studies have not been made. (auth)

1950 CF-58-10-40

Oak Ridge National Lab., Tenn.

DOWTHERM "A" JOURNAL BEARING TEST. W. E. Thomas. Nov. 6, 1958. 18p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The bearing housing of an overhung vertical shaft centrifugal pump, consisting of a plain journal bearing, one double row ball bearing, and two mechanical shaft face seals to contain the lubricant (Dowtherm "A"), was operated for a total of 3206 hr at 2600 rpm, pumping molten salt #30 at a temperature of 1200°F. (auth)

1951 CF-58-11-40

Oak Ridge National Lab., Tenn.

RESULTS OF EXAMINATIONS OF FUSED SALT MIXTURES BY OPTICAL AND X-RAY DIFFRACTION METHODS. R. E. Thoma. Nov. 14, 1958. 54p. Contract [W-7405-eng-26]. $9.30(ph OTS); $3.60(mf OTS).

A summary of results of examinations of fused salt mixtures is presented. Phase analyses are derived from the two complementing techniques: measurements of optical properties using the polarizing light (petrographic) microscope, and solid phase identification using x-ray-diffraction methods. Investigations of most of the samples on which data are reported were made as a part of a program of phase equilibrium studies of fluoride fused salt mixtures. (auth)

1952 ISC-900

Ames Lab., Ames, Iowa.

PREDICTION OF CONTINUOUS EXTRACTOR PERFORMANCE FROM SIMULATED EXTRACTION COLUMN DATA. Morton Smutz. [Sept. 1957.] 7p. Contract [W-7405-eng-82.] $1.80(ph OTS); $1.80(mf OTS).

A discussion of solvent extraction is presented with emphasis on solvent selection. It is pointed out that calculation methods for determining the operating conditions required for a given separation are well known; however, equilibrium data must be included. After sufficient equilibrium data have been obtained to ap-

proximate the flow ratios and the number of ideal stages required for a given separation, simulated column runs are made. The use of simulated column runs can provide information on the potentiality of the process and production rate in a particular type of extractor. By comparing results from one system with another, it is possible to estimate probable limiting production rates in a particular extractor, thus avoiding expensive pilot plant operations. (J.R.D.)

1953 KAPL-2000-3

Knolls Atomic Power Lab., Schenectady, N. Y.

REACTOR TECHNOLOGY QUARTERLY REPORT NO. 6. CHEMISTRY. Oct. 1958. 71p. Contract W-31-109-Eng-52. $2.00(OTS).

The procedure and apparatus are given for the determination of dissolved Ar in water. A platinum bath technique was used to improve vacuum fusion analysis of H_2, O_2, and N_2 in Zr and Zircaloy. Equipment was designed and developed for the hot extraction analysis of hydrogen in metals. The development of a method for the determination of microgram quantities of Th in Zircaloy-2 is presented. The use of x-ray fluorescence spectrometry for analysis of U in U–Zr ingot material is described. Procedures for the spectrographic determination of Al, Cu, W, Na, and Li, in zirconium and its alloys are given. A method was developed for the spectrographic determination of Co at low concentrations in stainless steel and its components. Spectrographic methods were developed for the estimation of Sr: Ca ratios in ground water, milk, and fish tissue. Anion-exchange chromotography and gamma scintillation spectrometry were used in radiochemical methods for analysis of activated corrosion-product samples and for determining cobalt specific activity. Neutron activation methods were developed for determining small quantities of Ag, Cd, and In in coolant water. The preparation and irradiation of U–Be intermetallic compounds are described. The nature of the reaction between water and boron carbide was studied Volatile dysprosium acetylacetonate was synthesized and its melting point, stability, and vapor pressure were investigated. The melting temperatures of plutonium oxide and certain plutonium oxide–uranium dioxide solid solutions were determined. The corrosion film produced on Zircaloy-2 by the action of high-temperature water is porous under simulated service conditions. Cadmium–indium–silver alloys were tested under conditions of dynamic corrosion. Inconel has low rate of corrosion in 60°F static water and appears to be resistant to intergranular corrosion and stress-corrosion cracking. (For preceding period see KAPL-2000-2.) (W.L.H.)

1954 LA-2229

Los Alamos Scientific Lab., N. Mex.

PLATING OF BERYLLIUM–COPPER COMPONENTS FOR ELECTRICAL APPLICATIONS (GOLD AND SILVER). A. G. Fox, B. W. Gilligan, J. J. Glass, J. K. Gore, G. S. Hanks, S. G. Johnstone, R. H. Moore, and J. M. Taub. Nov. 1957. 54p. Contract W-7405-ENG-36. $1.50(OTS).

The preparation of Be–Cu electrical components for plating is discussed, and specific processes are described in detail. The heat treatment techniques and end results are given considerable attention, but discussion is limited to the hardening of Be–Cu for electrical applications. Methods of racking the pieces for plating are described. The chemical preparation of Be–Cu prior to plating is described, and references are cited to enable the reader to investigate other preplating cycles. Plating baths and operating conditions are covered in detail. The cycle shown has been used successfully for over four years. A discussion of inspection procedures and acceptance sampling for quality control is included. (auth)

1955 NBL-151

New Brunswick Lab., AEC, N. J.

COLORIMETRIC DETERMINATION OF TRACES OF BROMINE IN URANIUM COMPOUNDS. M. W. Lerner. Nov. 1958. 10p. $0.50(OTS).

Traces of bromine in uranyl nitrate and hydrolyzed uranium hexafluoride solutions are determined by simultaneous oxidation of bromide with nitric acid-potassium permanganate and extraction of the bromine with carbon tetrachloride, reaction of the bromine with fluorescein to form eosin, and spectrophotometric determination of the eosin. With less soluble compounds, uranium dioxide, trioxide and tetrafluoride, a preliminary distillation step must be incorporated. (auth)

1956 NP-7030

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

PRECIPITATION OF AMMONIUM DIURANATE FROM URANYL NITRATE SOLUTIONS IN 40% TBP, IN MEPASINE. Report No. 33/IV. W. Korpak and C. Deptula. Aug. 1958. 4p.

The precipitation of ammonium diuranate from solutions of $UO_2(NO_3)_2$ in 40% tri-n-butyl phosphate (TBP) diluted with mepasine (paraffin hydrocarbons, boiling range 180 to 240°C) was carried out. Results are included. (W.L.H.)

1957 NP-7034

Stanford Research Inst., Menlo Park, Calif.

HIGH TEMPERATURE SYNTHESES OF NEW THERMALLY STABLE CHEMICAL COMPOUNDS. ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES ON HIGH TEMPERATURE CHEMISTRY. Quarterly Progress Report No. 1 (Report No. 3) [for] July 1 to September 30, 1958. Russell C. Phillips, F. Alan Ferguson, David L. Chamberlain, and Harold J. Eding. Oct. 10, 1958. 185p. SRI Project No. SU-2590. Contract AF33(616)-5940.

A research program directed toward preparation of new thermally stable compounds by chemical syntheses at 1000 to 2000°C is being conducted. The first phase of the program consisted of a literature survey for pertinent references to chemical reactions at temperatures above 500°C. The literature on spinels, suboxides, miscellaneous inorganics, metal organics, and organofluorine compounds was analyzed, and four areas for research were chosen. These areas included the following: synthesis of the postulated thermally stable spinels $MgSc_2O_4$ and $LiSc_5O_8$; study of the refractory boron suboxide system; study of the direct preparation of organo-metallic compounds at high temperatures; and synthesis of difluoroacetylene or hexafluorobenzene by pyrolysis of a suitable precursor, leading to stable fluoroorganic compounds. An annotated bibliography of high-temperature chemistry with 589 references is included. (J.R.D.)

1958 NP-7039

Eagle-Picher Research Labs. Mining and Smelting Div., Miami, Okla.

RESEARCH ON GROWING OF CADMIUM SULFIDE CRYSTALS FOR DOSIMETER PURPOSES. Final Report for Period April 17, 1957 to July 15, 1958. J. E. Powderly, K. E. Bean—W. E. Medcalf, ed. 77p.

DA Project 3-99-00-100. Contract DA-36-039-sc-73270.

The growth of cadmium sulfide single crystals of large size and with desirable properties was successfully carried out in a furnace consisting of an outer and inner chamber. By strategic location of the polished silica plates, total recovery of usable crystalline cadmium sulfide was 83 percent of theoretical. Single crystals weighing more than 100 grams were grown reproducibly. Obtaining large single crystals free of strain is accomplished only by obtaining precise temperature control and temperature gradient throughout the entire volatilization-deposition period of 100 hours. The optimum temperature conditions for crystal growth were determined. It was found, as a result of a statistical study in which 187 cadmium sulfide crystal specimens were irradiated with gamma rays, that crystals having dark resistivities in the range of 5×10^7 to 1×10^8 ohm-cm were in every case sensitive to gamma radiation but that a slightly lower resistivity range of 1×10^6 to 5×10^7 ohm-cm provided specimens with a greater maximum sensitivity. While not all the specimens in the latter range were sensitive to gamma radiation, those that were sensitive tended to have a higher degree of sensitivity than in any other resistivity range. Over 25% of the crystals showed an increase of more than 3 microamperes of current with irradiation of only 1 r/hr and with 175 volts DC applied across the electrodes. (C.H.)

1959 AEC-tr-3425

VAPOR PRESSURES OF MOLECULAR CRYSTALS (EIGHTH REPORT). VAPOR PRESSURES OF AROMATIC NITRO COMPOUNDS. Isamu Nitta, Syuzo Seki, Masanori (or Seijun) Momotani, and Kentaro Sato. Translated for Los Alamos Scientific Lab., from Nippon Kagaku Zasshi 71, 378-82(1950). 13p.

The vapor pressures of benzophenone, 1,3,5,-trinitrobenzene, trinitroanisole, trinitrotoluene, trinitrochlorobenzene, trinitropenetole and o-monochloronaphthalene were measured. The apparatus and procedure for these measurements are described, and the results are presented in tables. (J.R.D.)

1960 AEC-tr-3441

ON THE RELATION BETWEEN DETERMINATIONS OF VARIOUS METALS BY α-NITROSO-β NAPHTHOL (Co, Cu, Fe, V, Pd, U), MOLYBDIC ACID (Ca), PICROLONIC ACID (Ca, Ph, Th), AND URANYL ZINC ACETATE (Na) AND THE HYDROGEN ION CONCENTRATION. Kiyoshi Tanii, Hiroshi (or Hajime) Hoshimiya, and Masashi Ikeda. Translated from Nippon Kagaku Zasshi 61, 269-76(1940). 18p.

It is indicated that the hydrogen ion concentration is significantly related in the determinations mentioned in the title. The optimum conditions are as follows. (I) α-Nitroso-B-naphthol: i) Cobalt: pH < 8.74. ii) Copper: pH = 3.96 ~ 13.20. iii) Iron: pH = 0.95 ~ 2.00. iv) Vanadium: pH = 2.05 ~ 3.21. v) Palladium: pH < 11.82. vi) Uranium: pH = 4.05 ~ 9.38. (II) Molybdic acid: vii) Calcium: pH = 5.4 ~ 8.8. (III) Picrolonic acid: viii) Calcium: pH = 2 ~ 3. ix) Lead: pH = 2.0 ~ 6.5. x) Thorium: pH = 2 ~ 3.2. (IV) Uranyl zinc acetate: xi) Sodium: pH = 4.5 ~ 6.0. (auth)

1961 AEC-tr-3450

DIFFUSION PROCESSES IN A CATIONITE AND KINETICS OF ION EXCHANGE. M. Ya. Romankevich. Translated by Oak Ridge National Lab. Library Staff from Ukrain. Khim. Zhur. 24, 325-35(1958). 15p.

A method for preparing homogeneous phenol sulfonic cationite membranes for use in diffusion and ion exchange experiments is described. The degree of swelling of the cationite as a function of absorbed cations was investigated, and a change in cationite volume in varying acid concentrations was shown. In addition, the cationite diffusion coefficient was determined, and the coefficients of chloride salts, alcohols, and sugars were investigated. (J.R.D.)

1962 AEC-tr-3454

CRITICAL POINT ON THE POLYMORPHIC CONVERSION CURVE OF CERIUM. E. G. Ponyatovskii. Translated for Oak Ridge National Lab. from Doklady Akad. Nauk S.S.S.R. 120, 1021-3(1958). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 15986.

1963 AEC-tr-3455

THERMAL AND X-RAY PHASE ANALYSIS OF THE $CsF-BeF_2$ SYSTEM AND ITS INTERRELATIONS WITH Me^1F AND BeF_2 SYSTEMS. O. N. Breusov, A. V. Novoselova, and Yu. P. Simanov. Translated for Oak Ridge National Lab. from Doklady Akad. Nauk. S.S.S.R. 118, 935-7(1958). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 10428.

1964 AEC-tr-3458

A STUDY OF THE OXIDATION OF METALS UNDER THE CONDITIONS OF GLOW DISCHARGE IN OXYGEN. R. I. Nazarova. Translated by Lydia Venters (Argonne National Lab.) from Zhur. Fiz. Khim. 32, 79-85(1958). 16p.

The kinetics of the oxidation of Cu, Al, Fe, Mg, and Zn was investigated by using the materials as leads in the circuit of the oxygen glow discharge by means of gravimetric and volumetric methods. (W.L.H.)

1965 JPRS-1012

THE SULFUR METHOD OF DETERMINING OXYGEN (OXIDES) IN METALS. PART I. DETERMINATION OF OXYGEN IN THE OXIDES OF IRON, MANGANESE, COBALT, NICKEL, ARSENIC, LEAD, CADMIUM, ANTIMONY, AND COPPER. A. K. Babko, K. Ye. Kleyner, and L. V. Markova. Translated from Zavodskaya Lab. 22, No. 6, 640-5(1956). 11p.

Available from Photoduplication Service, Library of Congress.

For Part 2 see JPRS-617.

The determination is based on the interaction of sulfur vapors with oxides to form the sulfide of the metal and converting the oxygen quantitatively to sulfuric anhydride which is determined iodometrically. Reaction conditions are described for Fe_2O_3, Mn_2O_3, Co_3O_4, NiO, As_2O_3, PbO, CdO, Sb_2O_4, and CuO. (J.R.D.)

1966

A GROUP SEPARATION METHOD FOR GAMMA SPECTROMETRY OF COMPLEX RADIONUCLIDE MIXTURES, WITH SPECIAL APPLICATION TO STAINLESS STEEL AND ITS CORROSION PRODUCTS. K. Samsahl (Nuclear Chemistry Lab., AB Atomenergi, Stockholm). Acta Chem. Scand. 12, 1292-6(1958).

Short anion exchange columns coupled in series and saturated with chloride, citrate, and hydroxide ions have been used for simple and very rapid separations of common elements in water solutions as a pretreatment for subsequent analysis with gamma spectrometry. A

method was developed for the analysis of stainless steel, its corrosion products, and other elements present as impurities in a water-cooled nuclear reactor. Practical examples are described in detail. With this method it seems possible to measure continuously water corrosion rates of individual or small groups of stainless steel elements. (auth)

1967

PRELIMINARY NOTE ON THE SOLUBILITY OF OXYGEN IN α-ZIRCONIUM. Bo Holmberg and Arne Magneli (Univ. of Stockholm). Acta Chem. Scand. 12, 1341(1958).

An investigation was started on the solid solubility range of oxygen in α-zirconium. The solubility limit for samples heat-treated at 800°C was found to be about $ZrO_{0.40}$. After annealing at 800°C, the sample $ZrO_{0.30}$ gives x-ray powder photographs which show the oxygen atoms to be distributed at random in the interstices of the zirconium lattice. There are also indications of the vacancies in the oxygen positions being ordered. (J.R.D.)

1968

A NEW MICROGRAVIMETRIC METHOD FOR THE DETERMINATION OF THORIUM. Th. I. Pirtea and Georgeta Mihail. Akad. Nauk Univ. "C. I. Parhon," Ser. Stiint. Natur. No. 12, 51-5(1956). (Translated from Referat. Zhur. Khim. No. 1, 1958, Abstract No. 889.)

A microgravimetric method for the determination of thorium using Nasol's mercaptobenzthiazole is described. The alkali metals and magnesium do not interfere if they are in the form of salts of strong acids. The presence of free acid does interfere. The error in the determination is 0.1 to 2.2%. (J.S.R.)

1969

RELATION OF IONIC RADIUS TO STRUCTURES OF RARE-EARTH PHOSPHATES, ARSENATES, AND VANADATES. M. K. Carron, Mary E. Mrose, and K. J. Murata (U.S. Geological Survey, Washington). Am. Mineralogist 43, 985-9(1958) Sept.-Oct.

An investigation was made to assemble the available data and to correlate crystal structures of the rare earth compounds with ionic radii of the trivalent elements and the anions. (auth)

1970

THE DETERMINATION OF IMPURITIES IN CARBON DIOXIDE BY GAS CHROMATOGRAPHY, WITH SPECIAL REFERENCE TO COOLANT GAS FOR NUCLEAR REACTORS. D. G. Timms, H. J. Konrath, and R. C. Chirnside (General Electric Co., Ltd., Wembley, Eng.). Analyst 83, 600-9(1958) Nov.

It has been shown that, with a 25-ml sample, hydrogen, argon, oxygen, nitrogen, methane, and carbon monoxide present at levels as low as 5 to 20 p.p.m. in carbon dioxide can be determined by a gas-chromatographic method. Special features of the technique are the use of a molecular sieve as the solid adsorbent, the high speed of analysis and the use of a katharometer of high sensitivity. (auth)

1971

THE DETERMINATION OF MOLYBDENUM IN URANIUM AND IN MOLYBDENUM–URANIUM AND MOLYBDENUM–NIOBIUM MIXTURES. C. O. Granger (United Kingdom Atomic Energy Authority, Culcheth, Warrington, Lancs., Eng.). Analyst 83, 609-15(1958) Nov.

An improvement in the spectrophotometric determination of molybdenum by means of its complex with toluene-3:4-dithiol is described. This consists in forming the complex in an aqueous-solvent medium in which it is soluble, and therefore avoids the necessity for solvent extraction. When applied by difference, either in the presence or absence of uranium, the procedure has a coefficient of variation of ±0.16 per cent and can be applied to uranium–molybdenum alloys containing 0.2 per cent or more of molybdenum. Alternatively, if a non-difference procedure is used, concentrations of molybdenum in uranium down to 1 p.p.m. can be determined. With slight modification, the procedure is applicable to the determination of molybdenum in its alloys with niobium. The effects of impurities and of variations in temperature and acidity are discussed. (auth)

1972

THE PRACTICAL APPLICATION OF CHROMATOGRAPHIC THEORY TO ANALYTICAL AND PREPARATIVE SEPARATIONS BY ION-EXCHANGE ELUTION. F. W. Cornish (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Analyst 83, 634-42(1958) Nov.

Data are given from which adequate operating conditions can be deduced for the separation of ionic species by ion-exchange elution. (auth)

1973

ELECTROLYSIS OF LITHIUM HYDRIDE. M. A. Weinberger, T. J. Mousseau, and O. Maass (Defence Research Chemical Labs., Ottawa). Can. J. Chem. 36, 1455-60(1958) Nov.

A method has been developed whereby current yields of as high as 70% of anodically discharged hydrogen can be maintained during continuous electrolysis of lithium hydride at or just below its melting point. Efforts to utilize this process for the separation of hydrogen and deuterium were unsuccessful. (auth)

1974

THE DETERMINATION OF UO_3 AND U_3O_8 IN BROWN OXIDE. L. G. Stonhill (Eldorado Mining and Refining Ltd., Ottawa). Can. J. Chem. 36, 1487-92(1958) Nov.

Investigations leading to a method for the analysis of mixtures of the oxides UO_3, U_2O_5, and UO_2 are described. Uranic oxide is extracted with hot ammonium citrate solution, uranic and uranous-uranic oxides are determined together by solution in phosphoric acid followed by titration of U(VI) with titanous sulfate, and uranous oxide found by difference. (auth)

1975

THE SILVER PERCHLORATE-BENZENE COMPLEX, $C_6H_6 \cdot AgClO_4$, CRYSTAL STRUCTURE AND CHARGE TRANSFER ENERGY. Harold G. Smith and R. E. Rundle (Iowa State Coll., Ames). J. Am. Chem. Soc. 80, 5075-80(1958).

The silver perchlorate–benzene complex consists of –Bz–Ag–Bz–Ag– chains and perchlorate ions. The two silver ions associated with each benzene lie above and below the ring over bonds one and four of the ring. The silver ion positions are asymmetric and disordered, with Ag–C distances of 2.50 and 2.63 A to the two carbons of the nearest bond. The benzene ring is distorted; the two C–C distances nearest the silver ions are 1.35 A, the four others are 1.43 A. Evidently polarization of the π-bonding system leads to an increase in electron density in bonds nearest silver ions, and this is far more important than charge-transfer bonding in determining electron density within the ring. An attempt has been made to calculate the charge-transfer bond

energy, using crystal energies as a guide. The result is that the Ag...$\begin{matrix} C \\ | \\ C \end{matrix}$ charge-transfer bond energy is ~15.7 kcal/mole, and the estimated errors are such as to suggest that this is an upper limit. (auth)

1976

BEHAVIOR AND COMPOSITION OF ACID VANADATES. Francoise Chauveau. Compt. rend. 247, 1120-3(1958) Oct. 13. (In French)

The decavanadate structure of the vanadate acids was confirmed by the method of potentiometric surface applied to the titration curve of decavanadate acids and measurement of the pK of its fifth and sixth acidities with the aid of this curve. The results obtained were used to study the metavanadate-vanadate equilibrium. (tr-auth)

1977

DILATOMETRIC STUDY OF THE ZIRCONIUM–HYDROGEN SYSTEM. Lucien Espagno, Pierre Azou, and Paul Bastien. Compt. rend. 247, 1199-1202(1958) Oct. 20. (In French)

A very sensitive dilatometric study allowed the precise determination of the zirconium–hydrogen diagram and of the characteristics of eutectoid transformation (position by temperature, extended and reversible). A new transformation was found. (tr-auth)

1978

A NOTE ON THE SEPARATION OF LANTHANIDES FROM MIXTURES OF THEIR CHLORIDES. J. H. Freeman (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 7, 286-7 (1958) Oct.

Since a change in the covalent nature of lanthanides to chlorine bonding should be reflected in the solubilities of the chlorides in organic solvents, experiments were performed which indicate that the solubility differences exist and that it is possible to effect some separation of the lanthanides by fractional crystallization of their anhydrous chlorides from organic solvents. Separations were also effected by utilizing the difference in dehydration time of the lanthanide chlorides. This latter technique is difficult to control and since it cannot readily be adapted to a multistage separation it appears to be of less interest than the fractional crystallization method. (T.B.A.)

1979

COSMIC-RAY-INDUCED RADIOACTIVITIES IN METEORITES. I. CHEMICAL AND RADIOMETRIC PROCEDURES FOR ALUMINIUM, BERYLLIUM AND COBALT. W. D. Ehmann and T. P. Kohman (Carnegie Inst. of Tech., Pittsburgh). Geochim. et Cosmochim. Acta 14, 340-63(1958) Oct.

It is expected that the long-lived radionuclides Al^{26}, Be^{10}, and Fe^{60} (with its daughter Co^{60}), among others, are present in detectable amounts in meteorites as the result of the action of cosmic rays in space. For the detection and measurement of these activities, which have considerable potential significance, chemical isolation and purification are essential. Chemical procedures developed for the separation and purification of aluminum, beryllium, iron, and cobalt from iron and stone meteorites, tektites, and terrestrial silicate materials are described in detail. The prime objective was radiochemical purity of the isolated radioelements, chemical purity and chemical yields being of secondary importance. Ion-exchange and solvent-extraction techniques were used wherever possible because of their high specificity and applicability to very small quantities of elements. Al^{26} and Be^{10} are prepared for counting in the forms of Al_2O_3 and BeO. Fe^{60} is best detected by extraction of its active daughter Co^{60}, counted as CoS. The identity of a radionuclide is established by the criterion of constant specific activity upon recycling the sample through the chemical purification procedure. Special low-background counters have been constructed for the detection and measurement of feeble amounts of beta emitters in the form of small solid samples. The backgrounds are about 0.4 count min^{-1} and are exceptionally constant. In routine operation 3-4 day backgrounds are alternated with 6-8 day sample counts, yielding a lower counting rate limit (2σ criterion) of 0.017 count min^{-1}. With counting yields of about 40 per cent and specimen sizes of about 100 g, it is possible to detect radionuclides at a specific activity of 0.0004 dis min^{-1} (g specimen)$^{-1}$ in favorable cases. Thin-sample counting yields have been measured for Al^{26} and Na^{22}. Sample-thickness factors have been determined for Al^{26} in Al_2O_3 and Be^{10} in BeO. (auth)

1980

COSMIC-RAY-INDUCED RADIOACTIVITIES IN METEORITES. II. Al^{26}, Be^{10} AND Co^{60}, AEROLITES, SIDERITES AND TEKTITES. W. D. Ehmann and T. P. Kohman (Carnegie Inst. of Tech., Pittsburgh). Geochim. et Cosmochim. Acta 14, 364-79(1958) Oct.

The long-lived radionuclides Al^{26} and Be^{10} and the 5 year Co^{60} have been detected in stone and iron meteorites. The highest levels observed, in disintegrations per minute per gram of specimen were: in stone, Al^{26}, 0.063; Be^{10}, 0.0051; Co^{60}, 0.0018; in iron, Al^{26}, 0.0055; Be^{10}, 0.00070; Co^{60}, 0.033. The Al^{26} and Be^{10} were evidently produced by cosmic-ray bombardment of the meteorites before fall. The Co^{60} seems to have been produced principally by neutron capture in ordinary cobalt in recent years while the specimens were on earth, although disintegration of the long-lived Fe^{60} may contribute some Co^{60}. The Be^{10}:Al^{26} ratio is definitely lower in the Plainview chondrite than in the Richardton chondrite, suggesting that the former may have existed as a small body for only about a million years. The presence of both activities in the Odessa siderite indicates that it and its associated craters are probably less than about a million years old. The absence of these activities in the Canyon Diablo siderite is probably ascribable to a shielded position of the specimen inside the large meteoroid. Al^{26} is definitely and Be^{10} fairly certainly present in australites, indicating that tektites are glass meteorites and have spent at least a million years or so in space. Both activities are also present in Libyan Desert silica-glass, indicating that it is a variety of tektite. From the Al^{26} and Be^{10} levels or limits, in comparison with the levels in chondrites, the following approximate terrestrial ages or limits, in millions of years, are calculated: australites, <0.5; Libyan Desert silica-glass, ~3.5; bediasites, >1.2; moldavites, >3. Measurements of these and other nuclides can give valuable information on the pre-fall and post-fall histories of meteorites and on the past intensity of the cosmic radiation. The average cosmic-ray flux over the past several million years appears not to have been grossly different from the present value. (auth)

1981

FOCUSING ION EXCHANGE. VI. APPARATUS FOR CONTINUOUS SEPARATION OF METAL IONS (AND

OTHER ELECTROLYTES). Ernst Schumacher and René Flühler (Univ. of Zürich). Helv. Chim. Acta 41, 1572-81(1958). (In German)

An apparatus for continuous separation of metal ions by focusing ion exchange has to provide a homogeneous flow of suitable electrolytes normal to an electrical field, efficient cooling devices, and feeding and withdrawal systems allowing constant and adjustable liquid-flows. The first requirement was solved by a system of channels, separated from each other by ion-permeable diaphragmas and of such a size that internal convection currents produced by temperature gradients are viscosely damped. Thin glass plates form the separation unit and allow a maximum heat flow of 2 kw. Capillary feeding and withdrawal lines under adjustable hydrostatic or aspirator pressures give a reliable flow-pattern. Typical separations with Cu^{2+}/Co^{2+} and $Cu^{2+}/UO_2^{2+}/Sr^{2+}$ model-mixtures are described in detail. The apparatus is suitable for macro-preparative electrophoresis and offers advantages in comparison with recently reported devices for similar purposes. (auth)

1982

FOCUSING ION EXCHANGE. VII. QUANTITATIVE MICROANALYSIS OF HEAVY METALS AND RARE EARTHS. Ernst Schumacher and Hans Jakob Streiff (Univ. of Zürich). Helv. Chim. Acta 41, 1771-83(1958). (In German)

Focusing ion exchange as a method of separation of metal-ions, taking place in homogeneous solution in the presence of a complex-formation and an electrical-potential gradient, is compared with heterogeneous ion exchange and ionophoresis, and the distinctions are stressed. The phenomenon of "double-focusing", meaning the stationary existence of two lines of the same metal in the presence of two complexing agents (one of which is an amino-poly-acetic acid), offers a possibility for the estimation of μg- and ng amounts of various metals, including Fe^{3+}, Cu^{2+}, Pb^{2+}, Co^{2+}, Y^{3+}, and heavy rare earths. This can not be realized with ordinary ion exchange nor electrophoresis. One of the lines of a double-focus, being located on the acid side of a pH-gradient, changes its intensity proportionally to the added amount of a chelating agent (NTA, EDTA, Chel CD). Macro-chelatometry, using external indicators and direct and substitution titrations of metal-traces on a filter-paper strip, are described. The method is more accurate than various micro-chemical procedures. A phenomenological treatment of double-focusing is given. (auth)

1983

THE NATURE OF MAXIMUM OF ISOBARIC HYDROGEN ABSORPTION ON NICKEL, PLATINUM, IRON AND CHROMIUM AND OTHER METALS. N. N. Kavtaradze (Inst. of Physical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk No. 9, 1045-53(1958) Sept. (In Russian)

The existing explanations for the nature of the maximum related to isobars of hydrogen absorption on Ni, Pt, Fe, Cr, and other similar metals are discussed, and new reasons for the nature of the maximum based on equilibrated coexistence of atomic and molecular chem-absorption of hydrogen on Cr, Fe, Ni, and Pt are offered. The thermochemical and thermodynamic bases of the offered hypothesis are presented. (R.V.J.)

1984

HIGH-TEMPERATURE-RESISTANT CERAMIC ADHESIVES. Henry G. Lefort and Dwight G. Bennett (Univ. of Illinois, Urbana). J. Am. Ceram. Soc. 41, 476-82 (1958) Nov.

Ceramic adhesives were developed for bonding metal in the operational range 500 to 1000°F. When glassy-bond adhesives were suitably prepared and properly applied to types 302 and 17-7 PH stainless-steel specimens, shear strengths of the order of 2000 psi were obtained at a test temperature of 800°F, and shear strengths of more than 800 psi were obtained at 1000°F. Factors affecting adhesive strength included thermal-expansion fit between ceramic adhesive and metal, metal or metallic oxide additions to the adhesive glass, and the use of metal screens of selected wire and mesh dimensions as carriers in the adhesive joint. The ceramic adhesive could be applied to a precipitation hardenable type of stainless steel during part of the precipitation hardening treatment, which included heating the metal for various times at temperatures up to 1750°F. (auth)

1985

BISMUTH(I) CHLORIDE. John D. Corbett (Iowa State Coll., Ames). J. Am. Chem. Soc. 80, 4757-60(1958).

The reaction of $BiCl_3$ with excess bismuth below 323° results in the formation of solid BiCl. Although this three-phase system is metastable, limited contact between the trichloride and metal phases apparently restricts the yield to about 75 mole % BiCl. That the product is the reported bismuth(I) chloride is confirmed by its isolation in 98 to 99% purity by sublimation or benzene extraction of the unreacted $BiCl_3$ from the $BiCl-BiCl_3$ mixtures. The monochloride's principal reaction is disproportionation; it decomposes to trichloride and metal phases at 323°. The black, diamagnetic material is rather stable in air at room temperature. Powder pattern data given in the literature for $BiCl-BiCl_3$ mixtures as well as for two forms of $BiCl_3$ are found to be primarily those for the products of reaction of $BiCl_3$ with atmospheric moisture. No evidence for a non-stoichiometric BiCl phase or for the existence of $BiCl_2$ is found. The apparent occurrence of the monochloride as $(BiCl)_n$ is discussed. (auth)

1986

THE LOWER OXIDATION STATES OF GALLIUM. III. THE CONSTITUTION OF Ga_2Cl_4 AND ITS ANALOGY WITH $Ga(AlCl_4)$. Richard K. McMullan and John D. Corbett (Iowa State Coll., Ames). J. Am. Chem. Soc. 80, 4761-4(1958).

Dielectric constant measurements on benzene solutions of Ga_2Cl_4 give a dipole moment of 8.9 Debye units for this solute at infinite dilution. The same Raman spectrum is observed for benzene solutions of Ga_2Cl_4 and $Ag(GaCl_4)$. These results together with molecular weight data lead to the conclusion that Ga_2Cl_4 exists in benzene as the solvated ion pairs $Ga^+(GaCl_4)^-$ which aggregate with increasing concentration. Consideration of the absence of a stable gallium(I) chloride and the acid–base interaction resulting in the formation of $Ga(GaCl_4)$ leads to the concept of stabilization of lower oxidation states toward disproportionation by strong Lewis acids and to the preparation of $Ga(AlCl_4)$. The similarity of $Ga(GaCl_4)$ and $Ga(AlCl_4)$ is discussed. (auth)

1987

INTERMOLECULAR METAL-METAL BONDS AND ABSORPTION SPECTRA OF SOME NICKEL(II) AND PALLADIUM(II) COMPLEXES OF vic-DIOXIMES. Chalres V. Banks and Dennis W. Barnum (Iowa State

Coll., Ames). J. Am. Chem. Soc. 80, 4767-72(1958).

Intermolecular metal-metal bonds in certain square planar complexes of Ni(II), Pd(II), Pt(II), and Au(III) give rise to an absorption band in the visible region of the spectrum. This band gives rise to unusual dichroism in crystals of these complexes. The absorption spectra of single crystals of some nickel complexes were measured using plane polarized light and it was shown that complexes containing strong metal-metal bonds show "abnormal" dichroism while complexes with very weak metal-metal bonds show practically "normal" dichroism. The absorption spectra of colloidal suspensions of several of the complexes were measured. The position of the band due to metal-metal bonding depends primarily on the length of the metal-metal bonds, the central metal ion and the crystal structure. The position of this band also depends, but to a much lesser extent, on the particle size, since this affects the selective scattering of light on the long wave length side of an absorption band. (auth)

1988

PHASE SEPARATION IN METAL–AMMONIA SOLUTIONS. Kenneth S. Pitzer (Univ. of California, Berkeley). J. Am. Chem. Soc. 80, 5046-7(1958) Oct. 5.

The separation at low temperatures of alkali metal–ammonia solutions of about 4% metal into two liquid phases has seemed surprising. However, if one regards the ammonia as a dielectric medium within which the alkali metal ions and valence electrons move, then the phase separation may be understood as a vapor-liquid condensation. This model is developed semi-quantitatively and is found to be consistent with the experimental properties of the solutions. (auth)

1989

ACID-BASE REACTIONS IN FUSED SALTS. I. THE DICHROMATE-NITRATE REACTION. Frederick R. Duke and Marlowe L. Iverson (Iowa State Coll., Ames). J. Am. Chem. Soc. 80, 5061-3(1958).

The reaction $2Cr_2O_7^- + 4NO_3^- \rightarrow 4NO_2 + O_2 + 4CrO_4^-$ proceeds at a measurable rate in fused KNO_3–$NaNO_3$ eutectic at 250°. A kinetic study of the reaction demonstrates that the mechanism consists of two steps: the equilibrium $Cr_2O_7^- + 2NO_3^- \rightleftharpoons N_2O_5 + 2CrO_4^-$ followed by the slow step $N_2O_5 \rightarrow$ decomposition products. The presence of the equilibrium is demonstrated by adding metal ions which precipitate the chromate and noting the effect on the reaction rate. Also, one of the metal ions, Pb^{++}, is known to form complex ions with Cl^-; the effect on the rate of adding Pb^{++} and Cl^- simultaneously also shows the presence of the equilibrium reaction. (auth)

1990

STUDIES INVOLVING ISOTOPICALLY LABELLED FORMIC ACID AND ITS DERIVATIVES. IV. DETECTION OF CYANIDE (CN^-) IN A MIXTURE OF FORMIC ACID AND NITROGEN IN THE MASS SPECTROMETER. C. E. Melton and Gus A. Ropp (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 80, 5573(1958) Oct. 20.

Ion molecule reactions were examined using a modified spectrometer in which a field-free region was set up between the ionization chamber and the first accelerating plate. Ions produced from one gas in the ionization chamber are passed at low energy through neutral molecules of another gas introduced into the field-free space. The higher pressure in the chamber permits little back diffusion from the field-free region, and it is possible to determine which of two species furnishes the ion in an ion-molecule reaction by inverting the mode of two gases and noting the effect on the relative abundance of production. A series of experiments involving isotopically labeled formic acid, nitrogen-15, and carbon dioxide is conducted by this method, the conclusions of which are discussed. (J.R.D.)

1991

COPPER(II), NICKEL AND URANYL COMPLEXES OF SOME AMINO ACIDS. Norman C. Li, Brother Edward Doody, and James M. White (Duquesne Univ., Pittsburgh and Christian Brothers Coll., Memphis). J. Am. Chem. Soc. 80, 5901-3(1958) Nov. 20.

The formation constants of copper(II) and nickel complexes of hydroxyproline, asparagine and N,N-dimethylglycine have been obtained. The pK_2 of asparagine and the formation constants of its complexes are independent of the optical configuration. The nickel complexes of serine methyl ester and glycine methyl ester are equally stable, indicating that the serine ester coördinates to the metal ion through the amino group only. At pH 1.90, uranyl ion forms a 1 : 1 complex with glycine. In the pH region 3.0 to 4.3, the uranyl ion does not complex with glycine, hydroxyproline, asparagine, N,N-dimethylglycine and serine; only hydrolysis of the uranyl ion occurs. (auth)

1992

CONCERNING A LOWER OXIDE OF THORIUM AND RELATED COMPOUNDS OF THE LAST ROW ELEMENTS. Leonard I. Katzin (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 80, 5908-10(1958) Nov. 20.

The black residue found on treating thorium metal with concentrated HCl is shown by chemical tests to be equivalent to Th(II) in the form of ThO. Neutron diffraction indicates a lattice probably of the ZnS-type, which is consistent with ThO. Though its composition is more a function of acid concentration, the residue left on treating uranium metal with HCl apparently starts also as monoxide. It is inferred that similar residues seen on treating other of the last row metals with HCl are also monoxides. (auth)

1993

ADSORPTION OF FLUORIDE FROM DILUTE AQUEOUS SOLUTION. ADSORPTION BY SYNTHETIC ZIRCONYL SILICATE AND OTHER MATERIALS. Albert E. Taylor and Carl A. Jensen (Idaho State Coll., Pocatello). J. Am. Chem. Soc. 80, 5918-20(1958) Nov. 20.

Some studies on the fluoride adsorbancy of synthetic calcium monohydrogen phosphate and synthetic sintered and unsintered zirconium silicate and beryllium silicate were made. Ten ppm of fluoride was passed at about 0.3 ml/min through chromatographic tubes packed with the material under study together with diatomaceous earth, and the concentration of the fluoride in the effluent solution determined. The materials which were sintered with glass adsorbed very slight amounts of fluoride. Calcium phosphate and unsintered beryllium silicate adsorbed about half of the fluoride from 50 ml of 10 ppm fluoride solution. Unsintered zirconium silicate adsorbed all detectable fluoride from such a solution. One gram of zirconium silicate adsorbed as much as 5 mg of fluoride from solution. Passing 0.1 N sodium carbonate through the zirconium silicate columns caused adsorbed fluoride to be released; however, the extent of fluoride recovery by this method varied unpredictably between 30 and 100%. (auth)

1994

APPLICATION OF CHARGE-TRANSFER THEORY TO THE HEATS OF ADSORPTION OF THE INERT GASES ON CHARCOAL. D. G. Tuck (Cornell Univ., Ithaca, N. Y.). J. Chem. Phys. 29, 724-6(1958) Oct.

The adsorption of the inert gases on charcoal is considered from the viewpoint of charge-transfer no-bond complex formation, and interaction integrals are calculated from the heats of adsorption at effectively zero coverage. The numerical values obtained in this way are compatible with similar data in the literature. It is shown that the linear relationship previously reported between the heat of adsorption of the inert gases on charcoal and the polarizabilities of the gases can be satisfactorily derived on the basis of this theory, and arises to a large extent from the comparatively high ionization potentials of these elements. (auth)

1995

FLUORESCENCE SPECTRUM OF $PrCl_3$ AND THE LEVELS OF THE Pr^{+++} ION. G. H. Dieke and R. Sarup (Johns Hopkins Univ., Baltimore). J. Chem. Phys. 29, 741-5(1958) Oct.

$PrCl_3$ shows strong fluorescence from the $^3P_0$, $^3P_1$, and ^1D levels to all low-lying levels of the Pr^{3+} ion (^3H, ^3F, ^1G). This makes it possible to obtain all multiplet components of ^3H and ^3F. Previously unreported lines in the absorption spectrum are interpreted as transitions to the hitherto unknown $^1I_6$. Zeeman effect data corroborate this. All levels to be expected from a $4f^2$ configuration are now known for $PrCl_3$ except $^1S_0$ which should give a line in a different part of the spectrum. (auth)

1996

MOBILE ELECTRON MODEL IN A MAGNETIC FIELD. John A. Weil (Princeton Univ., N. J.). J. Chem. Phys. 29, 792-6(1958) Oct.

The motion of an electron in a circular loop containing equally spaced Dirac delta-function potential spikes is considered. This problem is solved exactly for the case when a static magnetic field is present, and is of physical interest for the π-electron motions in benzene. (auth)

1997

THERMODYNAMICS OF NONSTOICHIOMETRIC NICKEL TELLURIDES. II. DISSOCIATION PRESSURES AND PHASE RELATIONS OF TELLURIUM-RICH COMPOSITIONS. Edgar F. Westrum, Jr. and R. E. Machol (Univ. of Michigan, Ann Arbor). J. Chem. Phys. 29, 824-8(1958) Oct.

Dissociation pressures of tellurium over liquid and solid nickel telluride solutions have been measured with a silica Bourdon gage at compositions corresponding to $NiTe_{1.5}$, $NiTe_{1.7}$, $NiTe_{1.9}$, $NiTe_{2.0}$, and $NiTe_9$ at temperatures up to 780°. Modifications of the manometric technique are described which permit accuracies of 0.1 mm pressure and 0.1° at high temperatures with corrosive substances where the pressure is sensitive to impurities or to composition changes. The results, together with data on the vapor pressure of pure tellurium, define the partial molal free energies and entropies of tellurium and, together with direct eutectic temperature measurement, delineate features of the phase diagram for compositions with more than 60 at. % tellurium. (auth)

1998

COMPARISON OF THEORETICAL AND EXPERIMENTAL ELECTRON COLLISION CROSS SECTIONS FOR THREE EXCITATIONS IN HELIUM. S. M. Silverman (Air Force Cambridge Research Center, Bedford, Mass.) and E. N. Lassettre (Ohio State Univ., Columbus). J. Chem. Phys. 29, 891-4(1958) Oct.

A comparison of theoretical and experimental electron collision cross sections is made for transitions from the ground state of the helium atom to the 2^1S, 2^1P, and 3^1P excited states. (auth)

1999

EFFECT OF PRESSURE ON THE SPECTRA OF CERTAIN TRANSITION METAL COMPLEXES. R. W. Parsons and H. G. Drickamer (Univ. of Illinois, Urbana). J. Chem. Phys. 29, 930-7(1958) Oct.

The effect of pressure (to 130,000 atmospheres) has been measured on the splitting of the 3d levels of the nickel and chromium ions complexed with water and ammonia. Data have also been obtained on $CoSO_4 \cdot 7H_2O$ and $K_3Fe(CN)_6$. In general, the effect of pressure is to increase the effect of the ligand field and to increase the splitting of the levels. This is interpreted in terms of the change in ligand-metal distance. A phase transition was noted in $[Ni(H_2O)_6]SO_4$ at 65,000 atmospheres. A charge transfer band was also observed in $[Ni(NH_3)_6]Cl_2$. The effect of pressure is to increase the intensity with no apparent change in the location of the maximum. (auth)

2000

NMR AND HYPERFINE INTERACTIONS IN PARAMAGNETIC SOLUTIONS. R. G. Shulman (Bell Telephone Labs., Murray Hill, N. J.). J. Chem. Phys. 29, 945-7 (1958) Oct.

It is shown how indirect hyperfine interactions affect NMR properties in a variety of paramagnetic solutions. In particular the resonances are shifted from the normal resonance field of ϕ/γ_N by hyperfine interactions arising from complex formation with the magnetic ions. These concepts explain the resonance shifts and are useful in understanding the kinetic behavior, equilibrium constants, and chemical bonding of paramagnetic complexes. (auth)

2001

PHOTOVOLTAIC EFFECT AND PHOTOCONDUCTIVITY IN LAMINATED ORGANIC SYSTEMS. David Kearns and Melvin Calvin (Univ. of California, Berkeley). J. Chem. Phys. 29, 950-1(1958) Oct.

Magnesium phthalocyanine disks coated with a film of air-oxidized tetramethyl p-phenylenediamine were found to show the photovoltaic effect. The maximum voltage so far developed by one of these desks was 200 mv, and the maximum power 3×10^{-12} w. The cell construction and characteristics are described. In addition, a matrix of coronene coated with a thin layer of o-chloranil as an electron acceptor was studied, and other systems are also being investigated. (J.R.D.)

2002

DEUTERIUM ISOTOPE EFFECT IN PROTON NUCLEAR RESONANCE SPECTROSCOPY. George Van Dyke Tiers (Minnesota Mining and Manufacturing Co., St. Paul). J. Chem. Phys. 29, 963-4(1958) Oct.

The protons in the $-CH_2D$ groups of a deuterotoluene are 0.015 ± 0.002 ppm more shielded than are those in the $-CH_3$ group of deuterium-free toluene or p-deuterotoluene. The magnitude of the effect for protons is only about $1/_{49}$ of that for fluorine nuclei, but the direction of the shift indicates a greater electron-donated power for deuterium than for hydrogen. The equipment and

procedures for these experiments are described, and preparation of the reagents is discussed. (J.R.D.)

2003

ION-EXCHANGE PROPERTIES OF CELLULOSE PHOSPHATE. A. J. Head, N. F. Kember, R. P. Miller, and R. A. Wells (Chemical Research Lab., Teddington, Middlesex, Eng.). J. Chem. Soc. 3418-25(1958) Oct.

The ion-exchange properties of cellulose phosphate prepared by the urea-phosphoric acid method have been investigated. This material has been shown to possess a high affinity for certain cations, principally Th^{4+}, Ti^{4+}, U^{4+}, Ce^{4+}, Fe^{3+}, ZrO^{2+}, and UO_2^{2+}, which are adsorbed from 4N-acid. The influence of the preparative conditions and structure of the ester on its ion-exchange properties is described and discussed. (auth)

2004

NEW METHODS OF PREPARING POLONIUM METAL. K. W. Bagnall, P. S. Robinson, and M. A. A. Stewart (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc. 3426-8(1958) Oct.

Polonium metal has been prepared by the action of aqueous ammonia on polonium hydroxide and of anhydrous liquid ammonia on the hydroxide and some other polonium compounds. It can also be prepared by reducing polonium hydroxide with hydrazine, hydroxylamine, or sodium dithionite in alkaline solution and polonium tetrachloride with stannous chloride, titanous chloride, or sodium dithionite in hydrochloric acid. (auth)

2005

THE POLONIUM NITRATES. K. W. Bagnall, D. S. Robertson, and M. A. A. Stewart (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc. 3633-6(1958) Oct.

Polonium tetranitrate and two basic nitrates have been prepared, and evidence for the existence of a nitrite has been obtained. The cation-exchange behavior of polonium in nitric acid solution has been investigated. (auth)

2006

HIGH-PURITY CRYSTALLINE BORON. David R. Stern and Lahmer Lynds (American Potash & Chemical Corp., Whittier, Calif.). J. Electrochem. Soc. 105, 676-82 (1958) Nov.

Vapor phase reduction of boron trichloride with hydrogen on electrically heated filaments in flow systems was investigated as a potential method for the preparation of high-purity boron. Experiments were conducted on laboratory and bench-scale flow reactors. Conversion efficiency was a function of mole ratio of reactants, residence time, mass of deposit, and deposition temperature. Massive deposits of crystalline boron analyzing as high as 99.6% by direct chemical analyses were obtained. Purity of boron appeared to be a function of both filament diffusion and boron trichloride purity. Titanium filaments were found to be most satisfactory, since contamination due to titanium could be removed by chlorination at 300°C. X-ray-diffraction studies indicated that titanium probably existed in solid solution with boron rather than as a boride. (auth)

2007

METHODS FOR PREPARING PURE SCANDIUM OXIDE. F. H. Spedding, J. E. Powell, A. H. Daane, M. A. Hiller, and W. H. Adams (Iowa State Coll., Ames). J. Electrochem. Soc. 105, 683-6(1958) Nov.

A review of the techniques for isolating scandium in a pure state is presented, including the newest cation-exchange methods. These methods include elution with ethylenediaminetetraacetate and N-hydroxyethylethylenediaminetriacetate solutions and the use of copper and lead ions, respectively, as retaining ions which permit passage of scandium but retain rare earth ions. A new approach to opening thortveitite ore by treating with ammonium bifluoride and reducing the mixed metal fluorides to the metallic state with calcium is presented. (auth)

2008

THE COUNTING OF BARIUM CARBONATE IN A LIQUID SCINTILLATION SPECTROMETER. David G. Nathan, Jack D. Davidson, Jeanne G. Waggoner, and Nathaniel I. Berlin (U. S. Public Health Service, Bethesda, Md.). J. Lab. Clin. Med. 52, 915-17(1958) Dec.

A method is described for counting relatively large amounts of low specific activity $BaCO_3$ labeled with carbon-14. The technique is simple, adaptable, and reproducible with an efficiency of 56 per cent for 200 mg of $BaCO_3$. This technique obviates the need for low efficiency infinite thickness counting and replaces ionization chamber counting for most samples. (C.H.)

2009

EVIDENCE ON THE NATURE OF BISMUTH(I) CHLORIDE FORMED BY SOLUTION OF BISMUTH IN BISMUTH(III) CHLORIDE. John D. Corbett (Iowa State Coll., Ames). J. Phys. Chem. 62, 1149-50(1958)

Reported vapor pressure data of the $Bi-BiCl_3$ system at low temperatures are explained in terms of the essentially ideal solutions of Bi_4Cl_4 in $BiCl_3$. A different solution process probably must be invoked in order to account for the complete miscibility present in the system at high temperatures. (T.B.A.)

2010

STUDIES ON THORIUM-AMMONIUM AURINTRICARBOXYLATE CHELATE: PART I. PHYSICO-CHEMICAL INVESTIGATION OF THE COMPOSITION, STRUCTURE AND STABILITY. Anil K. Mukherji and Arun K. Dey (Univ. of Allahabad, India). J. Sci. Ind. Research (India) B17, 312-17(1958) Aug.

Ammonium aurintricarboxylate forms a colored chelate complex with tetravalent thorium. The complex, which has maximum absorption in the range 530 to 40 mμ, has been investigated by spectrophotometric and conductance measurements, using Job's method of continuous variation, and is found to contain the chelating agent and thorium in the proportion of 1:1. The structure of the complex has been discussed and it has been suggested that chelation occurs between the quinonoid oxygen and the adjacent carboxylic oxygen. The complex formation constant is 1.10×10^5 and the free energy of formation -6.9 kcal at 25°C. (auth)

2011

STUDIES ON THORIUM-AMMONIUM AURINTRICARBOXYLATE CHELATE: PART II. COLORIMETRIC DETERMINATION OF THORIUM. Anil K. Mukherji and Arun K. Dey (Univ. of Allahabad, India). J. Sci. Ind. Research (India) B17, 317-19(1958) Aug.

A colorimetric method for the microdetermination of thorium using ammonium aurintricarboxylate is described. The interference of various ions in the estimation of thorium with this reagent has also been investigated. For obtaining satisfactory results, the amount of the reagent to be used should be at least 20 times the molar concentration of thorium and the pH of the medium should be 5.00 ± 0.05. The smallest amount of thorium (Th^{4+}) that can be estimated with the reagent is 20 ppm. (auth)

2012
POLAROGRAPHY OF BERYLLIUM. G. Venkataratnam and Bh. S. V. Raghava Rao (Andhra Univ., Waltair). J. Sci. Ind. Research (India) 17B, 360-2(1958) Sept.

During polarographic determination of beryllium in a supporting electrolyte consisting of 0.5M lithium chloride and at pH 2.38, beryllium, at a concentration of 5×10^{-3}M, has been found to give two well-defined waves, having the values −1.79 V and −2.00 V for half wave potentials. The two waves correspond to the reductions $Be^{2+} \rightarrow Be^{1+} \rightarrow Be^{o}$. At pH 3.3 and below, the diffusion current at the first stage of the reduction remains proportional to the concentration of Be in solution up to 8×10^{-3}M. With the help of a working curve, the concentration of beryllium in a test solution has been calculated. (auth)

2013
A RAPID POLAROGRAPHIC PROCEDURE FOR THE ESTIMATION OF URANIUM IN ITS ORES. G. V. Subbarayudu and Bh. S. V. Raghava Rao (Andhra Univ., Waltair). J. Sci. Ind. Research (India) 17B, 363-5 (1958) Sept.

The use of organic salts as supporting electrolytes in the polarographic assay of uranium in its ores has been investigated. It is suggested that for niobotantalates (non-phosphatic ores) ammonium lactate may be employed and for monazite, dilute sulfuric acid. The uranium contents of a number of uranium-containing minerals, viz. samarskite, allanite and monazite, have been determined by this procedure. (auth)

2014
A NOTE ON THE USE OF POLYTETRAFLUOROETHYLENE IN VACUUM SEALS. A. J. Davies ("Shell" Research Ltd., Thornton Research Centre, Chester, Eng.). J. Sci. Instr. 35, 378-9(1958) Oct.

The method of preparing very thin films of polytetrafluoroethylene for use as vacuum seals is described. Cutting techniques are included along with cleaning methods and the heating process which forms the seal. (J.R.D.)

2015
A NEOPRENE VACUUM GASKET FOR WIRES. A. C. Prior (Royal Radar Establishment, Great Malvern, Worcester, Eng.). J. Sci. Instr. 35, 382-3(1958) Oct.

A method of sealing thermocouple wire holes in a vacuum furnace is presented. The method depends on the fact that excellent vacuum seals can be obtained by compression of a suitable block of neoprene through which the wire passes. The design allows easy removal of the wires, and wires of various diameters can be accommodated. (J.R.D.)

2016
RANDOM WALKS AND DRIFT IN CHEMICAL DIFFUSION. A. D. Le Claire (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 3, 921-39(1958) Sept.

In self diffusion the average displacement $\bar{X}(t)$ of an atom after a time t is zero. It is pointed out that in chemical diffusion $\bar{X}$ is not necessarily zero, for there are several mechanisms tending to make an atom jump preferentially in one direction rather than the other along a chemical concentration gradient, i.e. tending to produce a drift of atoms superimposed upon their otherwise random movement. This leads to a substantial modification of the classical Einstein equation $D = \bar{X}^2(t)/2t$ connecting the self-diffusion coefficient D with the mean square displacement $\bar{X}^2(t)$ and the equation for chemical diffusion which replaces it is derived. This is shown to lead, on the basis of a simple model, to Darken's equation for the chemical diffusion coefficient. Although in both this and a more general model there are usually two independent mechanisms contributing to $\bar{X}$, it turns out to be an interesting feature of chemical diffusion that only one of these is manifest in the chemical diffusion coefficient. The total drift $\bar{X}$ can be measured independently of the diffusion coefficient and values calculated from the theoretical expressions derived agree well with experimental measurements for zinc and for copper in α-brass/copper diffusion couples. The results are generalized for chemical diffusion in multicomponent systems and expressions obtained for the constants in the familiar schemes of equations used to describe multicomponent diffusion. It is concluded that the cross terms L_{ij} in the Onsager scheme are not primarily the result of correlation between the directions of successive jumps of atoms, as has been suggested. (auth)

2017
APPROXIMATE FORMULA FOR THE THERMAL CONDUCTIVITY OF GAS MIXTURES. E. A. Mason and S. C. Saxena (Univ. of Maryland, College Park). Phys. Fluids 1, 361-9(1958) Sept.-Oct.

An approximate formula for the thermal conductivity of multicomponent gas mixtures is derived from rigorous kinetic theory by well-defined approximations. Numerical calculations with the formula are relatively simple, and the only data needed are the molecular weights, thermal conductivities, and either viscosities or heat capacities of the pure components at the same temperature as the mixture. The form of the formula is quite similar to the earlier empirical Lindsay-Bromley equation. The formula is tested by comparison with experimental results on a number of binary and ternary mixtures involving both monatomic and polyatomic nonpolar gases. Agreement is satisfactory, and is nearly as good as obtained with the full rigorous theory. (auth)

2018
PROPERTIES OF GASES AT VERY HIGH TEMPERATURES. I. Amdur (Massachusetts Inst. of Tech., Cambridge) and E. A. Mason (Univ. of Maryland, College Park). Phys. Fluids 1, 370-83(1958) Sept.-Oct.

Known intermolecular force laws are used to calculate virial coefficients of the equation of state and the transport properties at very high temperatures for the rare gases and for molecular nitrogen. The crucial force laws which enable the calculations to be carried to high temperatures are those derived from molecular beam scattering measurements, which are valid at close distances of molecular approach. The calculations cover the temperature range from 1000 to 15,000°K, but take into account only the translation degrees of freedom and neglect the effects of excitation, dissociation, and ionization. The treatment of mixtures is outlined, and illustrated by calculations for the binary system helium-argon. The methods which are used offer an approach to the problem of obtaining reasonably accurate estimates of gas properties at temperatures so high that direct experiments would be extremely difficult, if not impossible. (auth)

2019
X-RAY STUDY OF ZIRCONIUM–HYDROGEN SYSTEM. Wlodzimierz Trzebiatowski and Bohdan Stalinski. Roczniki Chem. 30, No. 3, 691-6(1956). (Translated

from Referat. Zhur. Khim. No. 5, 1958, Abstract No. 13578).

Zr hydrides were produced at 400°C of spectrally pure Zr and H_2 obtained by thermal decomposition of Ti hydride. Nineteen preparations of composition from $ZrH_{0.10}$ to $ZrH_{1.99}$ were made, and they were studied by the powder method, as well as in Preston chambers. The radiations Cu-Kα and Fe-Kα were used. The accuracy of the lattice parameter determination was above 0.05%. Three phases (α, β, and γ) were revealed in the Zr–H system. The α phase is a solid solution of H_2 in hexagonal α Zr. It appears in the 2-phase region ($\alpha + \beta$) up to the composition $ZrH_{1.32}$. The face-centered cubic β phase (corresponding to the δ phase of Hegg) was found in the region of compositions from $ZrH_{0.25}$ to $ZrH_{1.70}$. The tetragonal body-centered γ phase (corresponding to the ϵ phase of Hegg) exists in the range from $ZrH_{1.66}$ to $ZrH_{1.99}$. The change of the lattice parameters of this phase with the rise of the H_2 content was established (a increases from 3.469 to 3.519 A, c decreases from 4.560 to 4.450 A).

2020

THE INFRARED SPECTRA OF CRYSTALLINE H_2O, D_2O AND HDO. D. F. Hornig, H. F. White, and F. P. Reding (Brown Univ., Providence). Spectrochim. Acta 12, 338-49(1958) Oct.

The infrared spectra of normal and deuterated ice prepared by freezing the liquid or by condensing the vapor were studied at temperatures to −190°C. No important spectral differences between the various specimens were found. The infrared spectra of H_2O, HDO and D_2O at −190°C were compared and the spectrum of crystalline HOD identified. Starting from the HOD spectrum, the spectra of H_2O and D_2O could be clarified. The band at 2230 cm^{-1} in ice is identified as the second overtone of a librational mode. The stretching region of ice consists of $2\nu_2$ at about 3150 cm^{-1}, ν_3 at about 3240 cm^{-1} and ν_1 at about 3350 cm^{-1}; D_2O is analogous. The cross-over between the frequency of ν_1 and ν_3 in passing from gas to solid is caused by a change in the stretch-stretch interaction constant. Its magnitude in ice, $f_{12} = 0.3$ cm dyn/Å, can be roughly explained on electrostatic grounds. The spectrum of the overtone region shows that the barrier to proton transfer in ice is greater than 27 kcal/mole. (auth)

2021

QUANTITATIVE SPECTROGRAPHIC ANALYSIS OF THE RARE EARTH ELEMENTS. IX. DETERMINATION OF RARE EARTH IMPURITIES COMMONLY ASSOCIATED WITH PURIFIED SAMARIUM, GADOLINIUM, TERBIUM, AND YTTRIUM. R. N. Kniseley, Velmer A. Fassel, Beverly B. Quinney, et al. (Iowa State Coll., Ames). Spectrochim. Acta 12, 332-7 (1958) Oct.

Emission spectrometric methods are described for the following quantitative determinations: neodymium and gadolinium in samarium; neodymium, samarium, terbium, europium, yttrium, dysprosium, and holmium in gadolinium; samarium, gadolinium, terbium, dysprosium, holmium, and erbium in yttrium; and samarium, gadolinium, yttrium, and dysprosium in terbium. These methods cover the concentration range from the detection limit up to 1 per cent. The basic method involves the direct-current carbon arc excitation of rare earth oxide–graphite mixtures, utilizing the unique similarity in excitation behavior of many of the rare earths to provide a high degree of internal standardization. The coefficient of variation is less than ±5 per cent in all instances. (auth)

2022

DETERMINATION OF INDIUM BY FLAME PHOTOMETRY. P. T. Gilbert, Jr. (North American Aviation, Inc., Downey, Calif.). Spectrochim. Acta 12, 397-400 (1958) Oct.

The flame spectrum of indium has been observed in air–hydrogen and oxy–hydrogen flames; the lines at 4511 and 4102 A are strongest, followed by 3256 and 3039 A. The 4511 line in oxy-hydrogen is best for quantitative determination, providing a detection limit of 0.01 ppm in aqueous solution, with a Beckman flame spectrophotometer equipped with multiplier phototube. The emission of indium at this wavelength is exactly proportional to concentration up to at least 100 ppm. Hydrochloric acid increases the background radiation and depresses the indium emission. In the determination of indium in the range 10 to 250 μg, the precision was 1% or better, attaining 0.1% under suitable conditions. (auth)

2023

THE GEOCHEMISTRY OF TRITIUM. Bruno J. Giletti, Fernando Bazan, and J. Laurence Kulp. Trans. Am. Geophys. Union 39, 807-18(1958) Oct.

The tritium concentration has been determined in precipitation, ocean waters, and ground waters. Although the steady-state tritium 'cycle' has been disturbed by thermonuclear testing, enough analyses of pre-test water have been made to conclude that: (1) the North Atlantic surface water has a natural mean T:H = 1.0×10^{-18} which doubled in 1954 because of the Castle tests, (2) this water mixes down to the seasonal thermocline in one year, (3) the North Atlantic Central Water appears to be 25 years old off the coast of Portugal, (4) measurable tritium was found in three bottom samples in the North Atlantic suggesting a young age for some of that water, (5) the hot waters of the Tecolote Tunnel, California, were from recent (nine months) rains, (6) direct runoff of precipitation from the ground surface to streams was at least three per cent of the total precipitation in the Hudson River basin in 1954, (7) the natural rate of production of tritium is calculated from a budget on the North Atlantic to be 0.75 ± 0.4 H^3 atoms/sec cm^2 of Earth's surface. (auth)

2024

POLARITY DIFFERENCES BETWEEN DEUTERATED AND NORMAL MOLECULES. E. A. Halevi (Israel Inst. of Tech., Haifa). Trans. Faraday Soc. 54, 1441-6(1958) Oct.

A method of dealing with polarity differences in the ground states of isotopically substituted species of simple polyatomic molecules is presented. The treatment is carried out with diatomic molecules, where such evaluation can be made, and is also extended to polyatomic molecules. (J.R.D.)

2025

NUCLEAR RESONANCE SPECTRA OF SOME FLUORINE DERIVATIVES OF TOLUENE AND BENZOTRIFLUORIDE. R. E. Richards and T. Schaefer (Lincoln Coll., Oxford). Trans. Faraday Soc. 54, 1447-53(1958) Oct.

High resolution hydrogen and fluorine nuclear magnetic resonance spectra have been recorded for o-, m-, and p-fluorotoluenes, for m- and p-fluorobenzotrifluo-

rides, and for difluoro-trichloro benzotrifluoride. The spectra are discussed in terms of the chemical shifts which occur internally between different nuclei of the same species in the molecule, and in terms of the spin-spin coupling constants between the nuclei. The values of the spin-spin coupling constants in these and similar molecules are discussed in terms of their molecular structures. (auth)

2026

THE THORIUM-APANS COMPLEX. A Spectrophotometric Study. A. R. Palmer (Australian Atomic Energy Commission Research Labs., Sydney). Anal. Chim. Acta 19, 458-61(1958) Nov.

The compound formed from thorium and Apans has been studied by spectrophotometric methods and shown to contain thorium and reagent in the ratio 1:2. The apparent stability constant of this complex has been measured as $1.4 \pm 0.1 \cdot 10^{10}$. (auth)

2027

A KINETIC STUDY OF THE DISSOLUTION OF UO_2 IN SULFURIC ACID. Theron L. Mackay and Milton E. Wadsworth (Univ. of Utah, Salt Lake City). Trans. Met. Soc. AIME 212, 597-603(1958) Oct.

Sintered UO_2 samples were leached in sulfuric acid solutions of various concentrations. A pressurized system was used so that it was possible to investigate the kinetics of the reaction to 270°C with oxygen overpressures as high as 900 psi. The rate was observed to be a function of the concentration of hydrogen ions and directly proportional to the partial pressure of oxygen. Evidences are presented which indicate that a UO_2 surface site reacts with a molecule of water to form a hydroxyl complex which in turn can dissociate with the characteristics of a weak acid. A rate determining step has been proposed which involves the reaction between an oxygen molecule and the hydroxyl complex on the surface of UO_2. (auth)

2028

MOLECULAR ELECTRONIC BIBLIOGRAPHY. Vol. I. Molecular Quantum Mechanics and Molecular Electronic Spectroscopy. Early Workers. Lilli Kasha and Michael Kasha. Tallahassee, Publishers Press, Inc., 1958. 141p.

This bibliography consists of all the research papers of 17 early investigators in the fields of molecular quantum mechanics and molecular electronic spectroscopy which appeared in Chemical Abstracts through December 1955. A total of 1,540 papers is listed. (W.D.M.)

Radiation and Radiochemistry

2029 AECU-3887

Michigan. Univ., Ann Arbor.

NUCLEAR CHEMICAL RESEARCH RADIOCHEMICAL SEPARATIONS AND ACTIVATION ANALYSIS. Progress Report No. 7 [for] November 1957 – October 1958. Dept. of Chemistry. Nov. 1, 1958. 95p. Project No. 7. Contract AT(11-1)-70. $2.75(OTS).

The present facilities at the University of Michigan for research in nuclear chemistry are described. The design and operation of a dual 100-channel pulse-height analyzer are described. A description is given of a three-inch scintillation crystal detector and housing. The resolution of the 3-in. × 3-in. NaI(Tl) crystal was determined as a function of gamma energy. These values are summarized. When high-purity Pt was irradiated for one minute, several unreported radiations were observed. A 0.074-Mev γ ray and a 2.5-Mev β ray decayed with a 31 ± 1 second half life while a 0.395-Mev γ ray decayed with a 46.1 ± 0.5 second half life. Radiochemical separation procedures are reported for cadmium. The separation of tin by various methods is presented. An apparatus was designed and set up to investigate the possibility of radiochemical separations, both with and without carrier, by vacuum distillation. The extraction of Zn and Ag from chloride solutions by various reagents is described. A new method for the separation of carrier-free Fr^{223} is presented. Methods for the determination of Rh, Ag, and In content of chondritic meteorites are presented. Methods are presented for the activation analysis for Se and Te in stony meteorites. A method is given for the determination of Rh in Ru metal by activation analysis. A method is described for the determination of V in petroleum process streams by activation analysis. Methods for determining V and As in marine organisms by activation analysis are presented. Chemical separation procedures are given for the separation of U from biological ash, As from biological ash, Rh from meteorite, Ag from meteorite, and In from meteorite. (For preceding period see AECU-3641.) (W.L.H.)

2030 USNRDL-TR-276

Naval Radiological Defense Lab., San Francisco.

THE EFFECTS OF "PROTECTIVE" ADDITIVES ON IRRADIATED AQUEOUS GEL SYSTEMS. L. H. Gevantman and J. F. Pestaner. Oct. 10, 1958. 15p.

A study is made of the reaction pattern produced in indicator-aqueous gel systems to which have been added selected substances known to exhibit a protective action upon biological systems. No change in the dimensional character of the patterns is observed except that indicative of a reduced radiation dose. Mechanisms for the protective action are proposed to account stoichiometrically for the results. (C.H.)

2031 AEC-tr-3459

EFFECT OF IRRADIATION ON THE VALENCE STATE OF PLUTONIUM IN NITRIC ACID SOLUTIONS. N. I. Popov, V. I. Medvedovskii, and N. A. Bakh. Translated by Lydia Venters (Argonne National Lab.) from Atomnaya Energ. 4, 154-60(1958). 15p.

The valence states of plutonium in nitrate solutions under irradiation were investigated. In addition to pure nitrate solutions, those containing both uranyl nitrate and potassium bichromate, which posesses the capability of reducing or oxidizing plutonium under the effect of radiation were studied. The experimental technique is described, and the results obtained in plutonium oxidation and reduction processes in solutions containing nitric acid, sodium nitrate, uranyl nitrate, and potassium bichromate in various concentrations and combinations are discussed. (J.R.D.)

2032 UCRL-Trans-370

DECOMPOSITION OF METHYL ALCOHOL BY Co^{60} γ-RAYS. Y. Yizuka, Y. Ouchi, K. Hirota, and G. Kusumoto. Translated for Univ. of Calif. Radiation Lab., Berkeley from Nippon Kagaku Zasshi 78, 129-31(1957). 6p.

Deuterated methyl alcohol was decomposed by γ rays, and the deuterium composition of the resulting hydrogen gas was analyzed. From the results obtained, the possible reaction mechanism leading to the formation of the hydrogen molecule was examined, and it was concluded that the initial step was a removal of the hydrogen atom

from the hydroxyl group. The resulting hydrogen atom then attacks another methyl alcohol molecule and takes a hydrogen atom from the methyl group, thus forming a hydrogen molecule. (auth)

2033

ISOTOPE EFFECT IN THE DECOMPOSITION OF GRIGNARD COMPOUNDS BY ORDINARY PHENOL AND A STERICALLY HINDERED PHENOL. Lars Olof Assarsson (Nobel Inst. of Chemistry, Stockholm). Acta Chem. Scand. 12, 1545-7(1958).

Results are reported from experiments on the decomposition of Grignard compounds, methyl-Mg-iodide and sec-butyl-Mg bromide, with phenol-t in n-butyl ether and ionol-t in n-butyl ether. (J.H.M.)

2034

ISOTOPE EFFECT IN THE METHANOLYSIS OF n-BUTYLMAGNESIUM BROMIDE. A REINVESTIGATION. Lars Olof Assarsson (Nobel Inst. of Chemistry, Stockholm). Acta Chem. Scand. 12, 1547-8(1958).

Results are reported from an experiment on the decomposition of n-butylmagnesium bromide with methanol in n-butyl ether. (J.H.M.)

2035

SEPARATION OF URANIUM(VI) BY PAPER CHROMATOGRAPHY. Gy. Almassy and M. Vigvari. Acta Chim. Acad. Sci. Hung. 11, No. 1-2, 1-6(1957). (Translated from Referat. Zhur. Khim. No. 5, 1958, Abstract No. 14179).

For the separation of U^{6+} from Fe^{3+}, Mg^{2+}, Ca^{2+}, Ni^{2+}, Co^{2+}, Zn^{2+}, Mn^{2+}, Al^{3+}, V^{5+}, Mo^{6+}, Pb^{2+}, Cu^{2+}, and Th^{4+} by the method of paper chromatography in ascending flow, it is best to use solvents containing HNO_3 and ethyl ether. Use is made of the specific solubility of the nitrate of U^{6+} from Fe^{3+} and other elements. A solvent of the following composition is used: 70 ml ethyl ether, 23 ml C_2H_5OH, and 7 ml concentrated HNO_3. The Rf of the U^{6+} zone is 0.84, and of the Fe^{3+} zone, 0.14. The Rf of the other cations is still lower.

2036

RESIN IMPREGNATED FILTER DISKS AND MEMBRANE FILTERS FOR THE ACTIVATION MEASUREMENT OF PRECIPITATIONS AND SUSPENSIONS. F. Scheffer and F. Ludwieg (Univ. of Gottingen, Ger.). Atompraxis 4, 331-2(1958). (In German)

The article describes two filters which are better than the paper filters used hitherto for measuring radioactive precipitates: resin-impregnated filter discs and glycerin-free membrane filters. The characteristics of these filters and their possible uses are described. (auth)

2037

THE KINETICS OF RADICAL REACTIONS IN THE TRACKS OF FAST ELECTRONS. A DETAILED STUDY OF THE SAMUEL-MAGEE MODEL FOR THE RADIATION CHEMISTRY OF WATER. P. J. Dyne and J. M. Kennedy (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Chem. 36, 1518-36(1958) Nov.

The kinetic behavior of a γ-ray spur produced in water, having H and OH radicals distributed spatially in the manner suggested by Samuel and Magee, has been studied using an electronic computer. The variation in yield of the molecular products H_2, H_2O_2, and H_2O with rate constants, diffusion constants, and spur size has been obtained. The model gives agreement with experiment choosing spurs with a small "radius" of the order of 10 A. On simple assumptions, however, the model predicts no difference in the molecular yields between heavy and light water and no isotopic separation in the formation of molecular hydrogen from isotopically enriched light water. Various special assumptions needed to give agreement with experiment for these isotope effects are discussed. The observed isotopic separation in the formation of molecular hydrogen is attributed to the preferential dissociation of an H atom from an excited HDO molecule. It is found that the yield of molecular hydrogen is less sensitive to the presence of scavengers than the yield of hydrogen peroxide. (auth)

2038

APPLICATION OF RADIOISOTOPES TO PHYSICAL CHEMICAL INVESTIGATIONS. J. M. Gamboa. Energia nuclear (Madrid) 1, No. 3, 53-66(1958) July-Sept. (In Spanish)

A survey is presented of the use of radioisotopes in physicochemical investigations. Tracer techniques are used in fundamental studies of isotopic exchange reactions, chemical kinetics, chemical structure, self-diffusion, and analytical chemistry. Microchemistry is facilitated by the use of radioisotopes. Chemical phenomena in nuclear reactions are discussed. (J.S.R.)

2039

ISOTOPIC EXCHANGE REACTIONS. IV. EVIDENCE FOR THE TETRACHLOROBORATE ANION FROM KINETIC STUDIES. Rolfe H. Herber (Univ. of Illinois, Urbana). J. Am. Chem. Soc. 80, 5080-3(1958) Oct. 5.

The halogen exchange between BCl_3 and a number of chloride salts has been studied in both the liquid and gas phase using Cl^{36} as a radiotracer. The heavy alkali metal salts do not undergo exchange at 0° in several hours. LiCl shows a small amount of halogen transfer in liquid BCl_3. Both $(CH_3)_4NCl$ and $(CH_3CH_2)_4NCl$ solutes exchange chlorine rapidly with liquid BCl_3 and the exchange with the former has been exploited to prepare radiochlorine labelled BCl_3. Silicon tetrachloride and trimethylchlorosilane do not exchange halogens with BCl_3 in the gas phase, although the latter should form a 1:1 addition compound with boron trichloride. These results are interpreted on the basis of an ionic mechanism which involves the formation of the tetrachloroborate anion in BCl_3 solution. (auth)

2040

RADIOLYSIS OF SIMPLE KETONES. P. Ausloos and J. F. Paulson (Univ. of Rochester, N. Y.). J. Am. Chem. Soc. 80, 5117-21(1958) Oct. 5.

The liquid and vapor phase radiolysis of acetone, methyl ethyl ketone, and diethyl ketone has been investigated briefly. The effect of temperature and scavengers on the G-values of the volatile products has been interpreted on the basis of known radical processes. In the case of acetone it has been shown that at least 85% of the methyl radicals are thermalized before abstracting a hydrogen atom from acetone. In the liquid phase recombination products were found to be present in appreciable amounts and were not removed by iodine or DPPH at concentrations up to 2.5×10^{-2} mole/1. (auth)

2041

USE OF SPARINGLY-SOLUBLE SALT-FORMING REAGENTS AS ELUTING AGENTS IN CATION-EXCHANGE PROCESSES. Hideo Yamatera (Osaka City Univ.). J. Inorg. & Nuclear Chem. 7, 299-300(1958) Oct.

Reagents that form sparingly soluble salts with the cation to be removed were examined as to their suitability as eluting agents in the cation-exchange processes. In every case tested, the reagents proved to be

effective, and in some cases were found to be of practical use. It was demonstrated that the perchlorate ions promote elution of the Cs ion. Experiments were also performed to confirm the effectiveness of nitric acid for elution of Sr and Ba, of $(NH_4)_2CO_3$ and Na_2CO_3 for elution of rare earths and Sr, and of $(NH_4)_2SO_4$ for elution of Sr. The results and probable explanation parallel that for Cs. (T.B.A.)

2042

KINETICS OF THE VANADIUM(II)–VANADIUM(III) ISOTOPIC EXCHANGE REACTION. Kotra V. Krishnamurty and Arthur C. Wahl (Washington Univ., St. Louis). J. Am. Chem. Soc. 80, 5921-4(1958) Nov. 20.

In 1.00 f $HClO_4$ and ionic strength 2.00 the rate of exchange between VII and VIII is consistent with the law rate = $k \cdot (V^{II})(V^{III})$. At 25° the value of k is 0.82 $f^{-1}\ min^{-1}$. The experimental activation energy is 13.2 kcal/mole. The rate was not affected measurably by a fivefold increase in the surface area of the reaction vessel, by the absence of ordinary diffuse light, by an increase in the ionic strength to 4.00 or by replacement of $NaClO_4$ by $LiClO_4$ for adjustment of ionic strength. The rate is increased by lowering the hydrogen ion concentration below 0.5 M and by the presence of chloride ion. The rate data are consistent with the expression $k = k_1 + k_2(H^+) + k_3(Cl^-)$, the values of the constants at 25° being $k_1 = 0.61\ f^{-1}\ min^{-1}$, $k_2 = 0.21\ min^{-1}$, and $k_3 = \sim 85\ f^{-2}\ min^{-1}$. (auth)

2043

USE OF HYDROGEN ISOTOPE EFFECTS TO DETERMINE THE TIMING OF PROTON TRANSFER RELATIVE TO NUCLEOPHILIC ATTACK IN THE ENOLIZATION OF KETONES AND REACTIONS OF EPOXIDES CATALYZED BY ACETIC ACID. C. Gardner Swain, Anthony J. Di Milo, and John P. Cordner (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 80, 5983-8(1958) Nov. 20.

Catalysis by acetic acid of enolization of α-phenylisocaprophenone in aqueous dioxane at 100° or of reaction of epichlorohydrin with iodide ion in water solution at 25° is not due to proton transfer during the rate-determining step, i.e., concerted with nucleophilic attack, but instead to proton transfer in a prior fast equilibrium step in each case, with the conjugate acid oxonium ion as a true intermediate. The magnitude of the proton/deuterium isotope effect determined by running these reactions in both light and heavy water is approximately unity, which is low considering that acetic acid is a considerably stronger acid than acetic acid-d but explicable if all proton transfers between oxygen atoms are equilibrium-controlled. The conspicuous absence of any third-order term in the mutarotation of tetramethylglucose in aqueous acetone catalyzed by pyridinium ion and by pyridine is consistent with a prior equilibrium for protonation by pyridinium ion. Evidence suggests that special cyclic polyfunctional mechanisms are responsible for the third-order acetic acid–acetate ion term in the enolization of acetone in water at 25° and for the acetic acid term in the mutarotation of glucose in water at 18°. (auth)

2044

STRUCTURE OF POTASSIUM HYDROGEN MALEATE BY NEUTRON DIFFRACTION. S. W. Peterson and Henri A. Levy (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 29, 948-9(1958) Oct.

The preliminary results of a neutron diffraction study are presented which confirm the existence in potassium hydrogen maleate of a short, strong, hydrogen bond and show the ion to be at least statistically symmetrical. The hydrogen is strongly linked to both neighboring oxygen atoms, and there is an existing mode of correlated motion of considerable amplitude in which the oxygen atoms are displaced but hydrogen is not. (J.R.D.)

2045

PARAMAGNETIC RESONANCE ABSORPTION IN NAPHTHALENE IN ITS PHOSPHORESCENT STATE. Clyde A. Hutchison, Jr. and Billy W. Mangum (Univ. of Chicago). J. Chem. Phys. 29, 952-3(1958) Oct.

The paramagnetic resonance absorption in naphthalene when single crystals of solid solutions of it in durene are irradiated at the boiling point of nitrogen with the light from a mercury lamp was observed. In naphthalene the triplet state is already split into three states in the absence of a magnetic field. The methods of measuring field strengths at resonance are described, and it is pointed out that the accuracy of these parameters improves with additional measurements. (J.R.D.)

2046

MASS SPECTROMETRIC OBSERVATION OF TRIATOMIC IONS IN CHLORINE AND BROMINE GASES. C. E. Melton, Gus A. Ropp, and P. S. Rudolph (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 29, 968-9 (1958) Oct.

A study was made to determine if the triatomic ions Cl_3^+ and Cl_3^- in pure chlorine result from the ionization of neutral Cl_3, and in addition, similar observations of bromine vapor were made. The investigation failed to establish whether any of the trimeric chlorine ions were derived from neutral Cl_3. (J.R.D.)

2047

ELECTRON IMPACT AND MOLECULAR DISSOCIATION. PART I. SOME STEROIDS AND TRITERPENOIDS. R. I. Reed (Univ. of Glasgow). J. Chem. Soc. 3432-6 (1958) Oct.

The mass spectra of fragments of some steroids and triterpenoids produced by bombardment with electrons of 9 to 15 ev energy indicate thermal fission during introduction of the molecules into the ion chamber. The scope and limitations of this technique are discussed, particularly for the determination of the length of the side-chain. Experiments with 30 to 70 ev electrons permit study of dissociations induced by electron impact and the spectra of cholestane, ergostane, lanost-9(11)-ene, and stigmastadiene fragments have been qualitatively interpreted. (auth)

2048

RADIATION CHEMISTRY OF CARBOHYDRATES. PART I. ACTION OF IONISING RADIATION ON AQUEOUS SOLUTIONS OF d-GLUCOSE. G. O. Phillips, G. J. Moody, and G. L. Mattok (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc. 3522-34(1958) Oct.

When irradiated in dilute aqueous solution, D-glucose is degraded to D-glucuronic acid, D-gluconic acid, glyoxal, D-arabinose, D-erythrose, formaldehyde, saccharic acid, and 1 : 3-dihydroxyacetone, which have been estimated quantitatively. Hydrogen peroxide is also formed. Under fully oxygenated and evacuated conditions, variation in glucose concentration and dose rate does not influence the yield of acid; the extent and pattern of degradation are the same for 1 Mev electrons and co-

balt gamma radiation. The liberation of gas indicates a post-irradiation process, also shown by changes in ultraviolet absorption spectra and hydrogen peroxide concentration. The absorption spectrum of the irradiated solutions shows a characteristic absorption maximum at 265 mμ sensitive to alkali; it is related to 1 : 3-dihydroxyacetone. By following the yield-dose curves for the main products, the primary and secondary products are distinguished. The main types of degradation are thus identified. (auth)

2049

RADIATION CHEMISTRY OF CARBOHYDRATES. PART II. IRRADIATION OF AQUEOUS SOLUTIONS OF DEXTRAN WITH GAMMA RADIATION. G. O. Phillips and G. J. Moody (University Coll., Cardiff, Eng.). J. Chem. Soc. 3534-9(1958) Oct.

The degradation of dextran in aqueous solution by Co^{60} γ radiation is examined by measuring the amount of acid formed and the changes in optical rotation and reducing power. Chromatographic and isotope dilution methods reveal that the main products are glucose, isomaltose, isomaltotriose, gluconic acid, glucuronic acid, glyoxal, erythrose, and glyceraldehyde. These products are considered to arise from at least two independent degradation processes: (a) hydrolysis to glucose, isomaltose, and isomaltotriose, while secondary reactions involving glucose give rise to erythrose, glyoxal and glyceraldehyde; (b) the formation of gluconic acid and glucuronic acid. The irradiated solution shows an absorption at 265 mμ due to dihydroxyacetone, which is also formed during the irradiation of glucose solutions. (auth)

2050

PRELIMINARY EXPERIMENTS ON THE RADIOMETRIC ESTIMATION OF TRACES OF THORIUM. K. R. Kar and B. C. Sawhney (Delhi Univ.). J. Sci. Ind. Research (India) 17B, 365-6(1958) Sept.

The estimation of traces of thorium (up to 30 μg) has been achieved by measuring the radioactivity of tagged phosphorus in chemical combination, as pyrophosphate, with thorium. Silver iodide (produced in situ) in dilute nitric acid (0.3N), and containing excess of iodide ions, has been used as a carrier for thorium pyrophosphate (P^{31}). The estimation can be completed within an hour with an accuracy of ±2 per cent. (auth)

2051

THE DEGRADATION OF POLYMETHACRYLIC ACID BY ULTRA-VIOLET AND X-IRRADIATION. J. H. Baxendale and J. K. Thomas (The University, Manchester, Eng.). Trans. Faraday Soc. 54, 1515-25(1958) Oct.

The kinetics of photolysis of hydrogen peroxide in the presence of propionic, trimethyl acetic, and polymethacrylic acid show that all the hydroxyl radicals produced in the primary step react with the acids in the experimental conditions used. Polymethacrylic acid is degraded in these conditions, and about two hydroxyl radicals are required for each chain-break. The polymer is also degraded by direct photolysis but with a low quantum efficiency. Both these degradation processes are retarded by air. X irradiation of polymethacrylic acid solutions gives hydrogen, carbon dioxide, and isobutene with 100 ev yields 0.58, 0.25, and 0.15, respectively. Degradation also occurs and, contrary to previous reports, is greater in de-aerated than aerated solutions. Hydrogen peroxide at concentrations 10^{-4} to 4×10^{-4} M enhances the degradation. It is concluded that hydroxyl radicals are responsible for the breakdown. (auth)

2052

SEPARATION OF URANIUM AND VANADIUM WITH THE AID OF ANION RESINS. Yu. V. Morachevskiy and M. N. Gordeyeva. Vestnik. Leningrad Univ. No. 10, 148-51(1957). (Translated from Referat. Zhur., Met. No. 3, 1958.)

In order to effect the separation of U and V by the ion-exchange method, use was made of domestic anionites which belong to the class of strong bases. A solution of HCl was first passed through a columnar container (with 10 g of the anionite) to charge the anionite with Cl^- ions. The hydrochloric acid solution to be investigated was then passed through the column at a rate of 1.5 cc/min. It was established that U is fully absorbed by the anionites if the acidity of the solution is 8N or higher, while the V passes into the filtrate in its entirety regardless of the acidity of the solution. U ions absorbed by the anionites were washed out with water. The determination of U and V was completed by colorimetric methods or by weighing. The relative error does not exceed 2% at U and V contents of 0.5 to 12 mg and 0.25 to 48 mg, respectively. (auth)

2053

SEPARATION OF SMALL AMOUNTS OF URANIUM(4) IN THE PRESENCE OF NIOBIUM AND TANTALUM BY MEANS OF A PHOSPHATE METHOD. Yu. V. Morachevskiy and I. A. Tserkovnitskaya. Vestnik. Leningrad Univ. No. 10, 152-4(1957). (Translated from Referat. Zhur., Met. No. 3, 1958).

A method was developed whereby small amounts of U can be deposited in the presence of Nb and Ta. Precipitation is carried out in tartaric acid solutions containing Nb_2O_5, Ta_2O_5, and UO_2Cl_2. The U is first reduced by an amalgam of Zn, a collector is added to it [1 cc of 2 percent solution of $Zr(NO_3)_4$], and both U and the collector are precipitated by a 10 percent solution of $(NH_4)_2HPO_4$. After dissolving the precipitate in a 10 N solution of H_2SO_4, the U is titrated with an 0.01 N solution of NH_4VO_3 with phenyltranyl acid. Final separation is achieved when the concentration of the tartaric acid is 0.5 g or less for every 100 cc of the solution. (TCO)

Separation Processes for Pu and U

Refer also to abstract 2614.

2054 AECD-3746

Los Alamos Scientific Lab., N. Mex.

THE EXTRACTION OF URANIUM FROM PHOSPHATE SOLUTIONS. H. R. Baxman. [1956?]. Decl. May 21, 1956. 9p. Contract [W-7405-eng-36]. $1.80(ph OTS); $1.80(mf OTS).

A process for the extraction and depoisoning of uranium in strong phosphoric acid solution with tributyl phosphate (TBP) is described. The formation of a complex between uranyl and phosphate ions necessitates the use of a salting agent which is capable of destroying this complex and releasing the uranyl ion into an organic extractable species. Of various salting agents tried, ferric nitrate was the most successful. It not only provides nitrate ion for the formation of uranyl nitrate, but also forms a very stable ferric-phosphate complex, thus completely tying up the phosphate ion when added in equimolar quantities. Stripping of the enriched solvent is accomplished with phosphoric acid. (auth)

2055 AERE-CE/M-228

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

SPECIFICATION OF THE EQUILIBRIUM COMPOSITION OF AN HAR FUEL SOLUTION WITH CONTINUOUS PROCESSING. D. Bradley. Aug. 1958. 15p. (HARD(B)/P-37). $0.35(BIS).

The equilibrium composition of the feed to the fuel processing system of a homogeneous aqueous reactor is calculated for a typical power reactor case. (auth)

2056 HW-52796

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

REDUCTION AND STABILIZATION OF PLUTONIUM NITRATE IN CATION EXCHANGE FEED AND PRODUCT SOLUTIONS. A. Brunstad and R. C. Smith. Sept. 24, 1957. Decl. Nov. 10, 1958. 18p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

In the concentration and purification of Pu by cation exchange, the feed solution must be in the plus three valence state, but the nitrate solution from a solvent extraction process contains a high % of Pu^{4+} and a small amount of Pu^{6+}. It was desired to find a reducing agent satisfactory for the reduction of Pu^{4+} and Pu^{6+} in Purex product streams and to make these streams suitable as cation exchange feed. The bisulfates met the requirements for speed and completeness of reduction in the feed material. (J.E.D.)

2057 NAA-SR-2778

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

THE PROCESSING-REFABRICATION EXPERIMENT (PRE) FOR IRRADIATED UO_2. D. I. Sinizer, E. G. Kendall, K. L. Mattern, D. J. Stoker, J. R. Foltz, G. E. Brand, and D. Janeves. [1958]. 67p. Contract AT-11-1-GEN-8. $12.30(ph OTS); $4.50(mf OTS).

The processing-refabrication experiment (PRE) was re-oriented toward development of equipment, methods, and techniques for remote processing and reconstitution of highly irradiated and short-cooled UO_2 fuel. In the first phase of the program, equipment and techniques for remote processing, shape reconstitution, and fuel rod fabrication will be mocked up and operated remotely with non-radioactive material. In the second phase, a large shielded cell structure and associated supporting services will be added to the facility at Santa Susana. The second-phase facility will contain hot cells for processing UO_2 fuel and reconstituting fuel shapes under an inert atmosphere. (W.L.H.)

2058 NP-7031

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

LIQUID IONITES FOR SORPTION OF URANIUM. Report No. 34/IV. W. Korpak, C. Deptula, and S. Goszczyński. Aug. 1958. 3p.

The synthesis and use of liquid ion exchangers were investigated. In the experiments a number of amines were examined, of which one proved suitable for extracting uranium from solutions of sulfuric acid in the presence of vanadium and iron. A solution of the amine in white spirit is a weakly basic liquid ion exchanger. No emulsion developed during either sorption or elution of uranium with weakly acid solutions of sodium chloride or nitrate, and equilibrium between the phases became rapidly established. (auth)

2059 ORNL-2519

Oak Ridge National Lab., Tenn.

DISSOLUTION OF SINTERED THORIUM–URANIUM OXIDE FUEL IN NITRIC ACID–FLUORIDE SOLUTIONS. W. D. Bond. Nov. 14, 1958. 19p. Contract W-7405-eng-26. $0.75(OTS).

Boiling 13 M HNO_3–0.04 M NaF appears to be a suitable dissolvent for the 96% ThO_2–4% UO_2 fuel element core material similar to that to be used by Consolidated Edison. Dissolution of unirradiated ¼-in.-diam pellets was 98% complete in 5.3 hr, producing a final product solution of 8.6 M HNO_3–1 M $Th(NO_3)_4$–0.041 M $UO_2(NO_3)_2$ at an over-all average dissolution rate of 3.4 mg/cm^2·min. Extrapolation of the rate data indicates that complete dissolution could be achieved in 6 to 7 hr. A stepwise procedure with fresh dissolvent would produce faster dissolution rates. The total dissolution time was 1 to 2 hr for pellets that had been crushed to a powder. Sulfuric, nitric, and hydrofluoric acids and aqua regia were ineffective dissolution agents. (auth)

2060

THE SPACE GROUP AND SOME DATA ON THE CRYSTAL STRUCTURE OF URANYL NITRATE HEXAHYDRATE $UO_2(NO_3)_2.6H_2O$. K. Sasvari (Academy of Sciences of Hungary). Acta Geol. Acad. Sci. Hung. 4, No. 3-4, 467-8(1957). (Translated from Referat. Zhur. Khim. No. 4, 1958, Abstract No. 10397)

The results of a preliminary x-ray study of the crystalline structure of $UO_2(NO_3)_2.6H_2O$ (I) are reported. The accuracy of earlier determined lattice parameters (Amer. Chem. Soc. 46, 1615(1924)) was confirmed by the study, and the space group of I C_{2v}^{12} in the aspect $A2_1ma$ (presence of the piezoelectric effect) was established. The intensity analysis showed that the z coordinates of U atoms and of a part of the O atoms are near to ⅛.

2061

SHORTCUT TO URANIUM FUELS. C. H. Chilton. Chem. Eng. 65, No. 21, 138-41(1958) Oct. 20.

A process flowsheet for production of UO_2 from ore concentrates or scrap and the enrichment of this material with U^{235} using UF_6 from the gaseous diffusion process is described. The end product from the process is enriched, ceramic-grade UO_2. (J.R.D.)

2062

URANIUM SELENIDE U_2Se_3. Parviz Khodadad. Compt. rend. 247, 1205-6(1958) Oct. 20. (In French)

The selenides USe_3, $U_\alpha Se_2$, $U_\beta Se_2$, and $U_\gamma Se_2$ when heated between 700 and 1200°C either in a current of hydrogen or under vacuum give a selenide of the formula U_2Se_3. Some physical and chemical characteristics of the compound were studied. (tr-auth)

2063

THE DEVELOPMENT OF THE BUTEX PROCESS FOR THE INDUSTRIAL SEPARATION OF PLUTONIUM FROM NUCLEAR REACTOR FUELS. C. M. Nicholls (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Brit. Nuclear Energy Conf. 3, 279-89(1958) Oct.

The chemical engineering work done in Canada in developing the Butex Process is described. (auth)

2064

FUEL PROCESSING IN HOMOGENEOUS AQUEOUS REACTORS. I. Wells (United Kingdom Atomic Energy Authority, Springfield, Lancs, Eng.) and E. Lofthouse (Imperial Chemical Industries Ltd, Widnes, Lancs,

Eng.). J. Brit. Nuclear Energy Conf. 3, 308-14(1958) Oct.

The relevant features of the homogeneous aqueous reactor are summarized, and the special processing problems are discussed. It is believed possible to design such a reactor so that more fissile material is produced than is consumed, but in order to do this it is essential to keep to a minimum the wasteful absorption of neutrons in extraneous atoms. For this reason, together with the need for chemical stability under radiation, the number of chemical compounds suitable as fissile and fertile materials is limited. (auth)

2065

SEPARATION OF URANIUM AND THORIUM. S. V. Suryanarayana and Bh. S. V. Raghava Rao (Andhra Univ., Waltair). J. Sci. Ind. Research (India) B17, 310-12(1958) Aug.

A simple and direct ion-exchange method has been suggested for the separation of uranium from thorium. Both the elements are adsorbed by the resin (Amberlite IR) from which uranium can be eluted first with 1.70 M hydrochloric acid. After neutralizing the acid by running ammonia solution through the resin column, thorium is eluted with 1.1 M ammonium carbonate solution. A bed 1 cm in diam can handle 0.06 g of U_3O_8 in the presence of about 0.25 g of thoria. (auth)

2066

FLUORESCENCE OF URANYL SALTS IN SOLUTIONS. Milan Novak. Jaderna Energie 3, No. 2, 44-7(1957). (Translated from Referat. Zhur. Khim. No. 1, 1958, Abstract No. 895.)

Measurements of the fluorescence of various uranyl salts were made as a function of uranium concentration. The results are tabulated. The method can be used for the quantitative determination of uranium only in concentrated H_2SO_4 solutions of pure uranyl salts. The error in the measurements was higher than 10%. (J.S.R.)

2067

THE EXTRACTION OF ZIRCONIUM WITH TRI-n-OCTYLPHOSPHINE OXIDE AND ITS DIRECT DETERMINATION IN THE ORGANIC PHASE WITH PYROCATECHOL VIOLET. J. P. Young and J. C. White (Oak Ridge National Lab., Tenn.). Talanta 1, 263-75 (1958) Sept.

CONTROLLED THERMONUCLEAR PROCESSES

2068 NRL-5200

Naval Research Lab., Washington, D. C.

STRONG SHOCK WAVES IN HELIUM—HYDRODYNAMIC CALCULATIONS I. C. E. Faneuff, A. D. Anderson, and A. C. Kolb. Aug. 12, 1958. 52p. Project NR-550-000.

Calculations of the shock parameters for helium are carried out for temperatures between 16,000 and 87,000°K and for ambient densities in the range 0.1 to 40 mm Hg. The effect of single ionization is taken into account preliminary to a more detailed analysis which includes the effect of double ionization, bound state excitation, and the temperature-density dependence of the partition functions. Experimental evidence for Mach numbers greater than 100 in helium is discussed briefly. (auth)

2069 NYO-999

Princeton Univ., N. J. Project Matterhorn.

ON THE IONIZATION AND HEATING OF PLASMA. Lyman Spitzer, Jr., and Louis Witten. Mar. 27, 1953. Decl. Aug. 25, 1958. 47p. Contract AT(30-1)-1238. (PM-S-6). $7.80(ph OTS); $3.30(mf OTS).

Different methods for ionizing and heating a plasma are considered. To simplify the problem the plasma is assumed confined in an infinite cylinder by a magnetic field parallel to the cylinder axis. Consideration of heating by collisions with energetic electrons or protons or by steady electrostatic fields shows that these methods seem much less promising than heating and ionization by means of induced electrical fields. Two specific methods are considered in detail. In one, called "relaxation heating," changes in the external magnetic field B, produce an electrical field perpendicular to B and charged particles are accelerated as in the betatron. If the frequency of oscillation of B is about equal to the collision frequency, the phase lag between the kinetic energy in directions perpendicular to B and the corresponding energy of motion along B produces a systematic net heating in each cycle. However, the effect does not seem sufficiently great to be practical, if the variation of B is sinusoidal. In the second method, called "induction heating," an electrical field is induced parallel to B by means of changes in a second magnetic field external to the cylinder. If the angular frequency of oscillation, ω, of this electrical field is large compared to the collision frequency, the theory of heating becomes relatively simple. The electron velocities oscillate back and forth in each cycle, while occasional ionizing collisions produce a gradual exponential increase in the electron density until full ionization is approached. Computations have been carried through for an electrical field which produces oscillations in the electron velocity of 6×10^8 cm/sec, corresponding to an energy of 100 volts. In this case, the time in seconds required for the electron density to e-fold in a gas of pure H_2 is $3.0 \times 10^7/n(H_2)$. Brief consideration is given to the situation in which ω is much smaller than the collision frequency. The diffusion of particles to the wall of the cylinder, either by microscopic collisions, or by plasma oscillations, is arbitrarily assumed negligible. Also the effects introduced if a finite geometry is substituted for the infinite cylinder are ignored in this idealized problem. (auth)

2070 NYO-2195

Princeton Univ., N. J. Project Matterhorn.

QUARTERLY REPORT COVERING THE PERIOD JULY 1—SEPTEMBER 30, 1958. 41p. Contract AT(30-1)-1238. (PM-Q-4). $7.80(ph OTS); $3.30(mf OTS).

The B-1 stellarator continued studies of the early phases of ohmic heating and the effort on B-3 was largely devoted to a number of modifications—the most important of which was the addition of helical windings, a change which theoretically should make the system hydromagnetically stable. On B-65, effective coupling of a high power oscillator to the plasma at ion cyclotron resonance frequencies was demonstrated. Etude was brought into operation and as a result of the high pulse repetition frequency has proven to be a very effective experimental device. A mass spectrograph has been successfully operated inside the discharge tube of Etude. The C Stellarator Associates prepared an overall system layout drawing for first stage operation, brought to virtual completion preliminary design of

Stage I components and are well along in detailed design of these components. (auth)

2071 NYO-6041

Princeton Univ., N. J. Project Matterhorn.
THE CONTROLLED RELEASE OF THERMONUCLEAR ENERGY. Lyman Spitzer, Jr. Apr. 14, 1953. Decl. Oct. 20, 1958. 51p. (PM-S-8). $9.30(ph OTS); $3.60 (mf OTS).

The nuclear energy stored in H^2 and Li^6 on the earth's surface could, if tapped, provide an inexhaustible supply of power. Release of this power by thermonuclear fusion reactions requires temperatures of about 10^8 degrees K. Confinement of such a hot, completely ionized gas can be achieved by a strong magnetic field in a closed but endless tube, with the lines of force parallel to the wall. Losses of thermal energy to the wall by atomic diffusion and by photon emission would be less than the thermonuclear energy produced, and thus the reaction could be self-sustaining. Two different systems have been proposed. In one, the magnetic field is produced by electrical currents in the gas within a toroidal tube. In the other, the magnetic field is produced by external currents around a tube shaped in a figure-8. Heating in either system would be produced by induced electrical fields. Either system might be used for practical power generation if the gas were stable against instabilities and turbulence of various types. Lack of information on such cooperative electromagnetic phenomena prevents an evaluation of these proposed techniques. (auth)

2072 NYO-6043

Princeton Univ., N. J. Project Matterhorn.
ON THE PULSE METHOD OF IONIZATION AND HEATING OF A PLASMA. J. M. Berger and E. A. Frieman. Oct. 7, 1953. Decl. Aug. 25, 1958. 37p. Contract AT(30-1)-1238. (PM-S-10). $6.30(ph OTS); $3.00(mf OTS).

The ionization and heating of the electrons of a helium plasma were calculated for four cases: (1) with constant electrical field, $E = 4.5 \times 10^{-2}$ volts/cm along the axis of the stellarator and density of helium atoms, $n = 3 \times 10^{13}$/cc, (2) with constant electrical field $E = 4.5 \times 10^{-3}$ volts/cm and $n = 3 \times 10^{13}$/cc, (3) with constant current density in the plasma, $j = 30$ amp/cm^2 and $n = 3 \times 10^{13}$/cc, and (4) with constant current density $j = 1000$ amp/cm^2 and $n = 10^{15}$/cc. For case (1) the temperature variation of the ions and also the number of photons emitted in the 4686 A line of He II are calculated. The circuit designed for the constant electrical field heating is also described. The results for the calculations in case (1) are encouraging in that complete ionization is achieved in times of the order of 2 milli seconds, however the ion temperature is found to lag very much behind the electron temperature. A means is suggested for improving this last situation. (auth)

2073 NYO-6046

Princeton Univ., N. J. Project Matterhorn.
HEATING OF A PLASMA BY MAGNETIC PUMPING. Jay M. Berger. May 1954. Decl. Oct. 20, 1958. 43p. Contract [AT(30-1)-1238]. (PM-S-13). $6.30(ph OTS); $3.00(mf OTS).

The heating of the plasma in the Model B-2 Stellarator by the method of magnetic pumping is analyzed in three physical situations. In the first case, called transit time heating, the time between collisions is large compared to the transit time of an ion through the R.F. pumping field or to the time of oscillation of this field. In the second case, collision heating, the time between collisions is about equal to the oscillation time, while the transit time is assumed much longer, so that motion of the particles in the field direction may be neglected. In the third case, or acoustic heating, the transit time and the oscillation time are again comparable, as in transit time heating, but the collision time is so short that the usual acoustic approximation may be made. The results of the calculations are found to be favorable for the raising of the temperature of the deuterons or He^{2+} ions in the plasma from about 30 e.v. to 300 e.v. in less than 10^{-3} sec, the confinement time hoped for in Model B-2. The results of the calculations to a proposed Model D stellarator designed to produce thermonuclear power are applied. (auth)

2074 ORNL-1960

Oak Ridge National Lab., Tenn.
THE INFLUENCE OF END MIRRORS, HIGH DENSITY AND LONG TUBE LENGTH ON RADIAL DIFFUSION. Albert Simon. Sept. 22, 1955. Decl. Nov. 7, 1958. 18p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40 (mf OTS).

Diffusion in an arc plasma across a magnetic field is investigated. The geometry is similar to that reported in ORNL-1890 but with the addition of magnetic mirrors on the ends of the arc chamber. It is shown that mirrors do not eliminate the "short circuit" effect. Comparison of the e-folding length, r_0, of the radial ion density with and without mirrors, affords a direct measurement of l/λ, where l is the arc length and λ the mean-free-path. In addition r_0 is independent of gas pressure with mirrors and varies as $\sqrt{P}$ without mirrors. The condition for the elimination of the "short circuit" effect is discussed, as well as the case in which the "short circuit" is still present but the ions diffuse (rather than stream) to the end walls. In this case r_0 is directly proportional to the gas pressure. These effects are compared to some experimental results of Neidigh. (auth)

2075 UCRL-5109-T

California. Univ., Livermore. Radiation Lab.
LARGE TOROIDAL STABILIZED PINCH PROPOSAL. S. A. Colgate and P. H. Furth. Jan. 29, 1958. Decl. Sept. 17, 1958. 21p. Contract [W-7405-eng-48]. $7.80 (ph OTS); $3.30(mf OTS).

Justification is given for a proposed program aimed at achieving a high-conductivity long-containment-time stabilized pinch in a torus of 4 to 6 ft minor diameter. The program is to consist of two parallel projects. The first is the initiation of a high-purity pinch discharge with a 10^6 joule capacitor bank, and the "crowbarring" of this discharge into a 2×10^7 watt d-c generator, if its containment time is sufficiently long. The second project is the development of a 10^8 joule inductive energy storage facility, to be partly discharged in 0.1 sec., and to serve during a subsequent "crowbar" stage as power amplifier of the 2×10^7 watt d-c generator. (W.D.M.)

2076

ENERGY DISTRIBUTION OF ELECTRONS IN A VERY HIGH FREQUENCY DISCHARGE IN HYDROGEN. F. Ciorăscu. Acad. rep. populaire Roumaine rev. phys. 3, 21-32(1958).

The energy distribution of electrons in a very high-frequency discharge in hydrogen at various pressures was studied. To establish a relation the values of the dielectric constant of the ionized gas and of its conductivity with the degree of ionization of the gas, an attempt was made to determine the density and temper-

ature of the free electrons with a Langmuir probe. The results compared with values deduced from conductance and susceptance measurements showed that the values given by the probe were systematically larger. The interpretation of the experimental results is discussed, and it is shown that under the experimental conditions, the frequency of the electronic collisions at a given pressure is a constant for the lower electron temperatures. (J.S.R.)

2077

ELECTRICAL DISCHARGES IN HIGH VACUUM. G. Schmidt. Acta Phys. Acad. Sci. Hung. 9, 1-12(1958).

Measurements were made to investigate the mechanism of the breakdown in high vacuum and of the discharge preceding the breakdown. The results of the measurements were at variance with the theory of Van de Graaff and Trump, as well as with that of Cranberg, and showed that the mechanism of a breakdown in high vacuum is identical with the events observed by Boyle at very low voltages. Thus, it was found possible to form a uniform picture by which many already well-known phenomena can be explained. (auth)

2078

ON THE SEISMOLOGICAL ASPECTS OF THE 1954 HYDROGEN BOMB EXPLOSIONS. T. N. Burke-Gaffney (Riverview Coll. Observatory, Australia) and K. E. Bullen (Univ. of Sydney). Australian J. Phys. 2, 318-21 (1958) Sept.

Tentative conclusions previously drawn from an analysis of seismic readings of four 1954 hydrogen bomb explosions are re-examined in the light of source data subsequently released on these explosions. The released data show that earlier computed origin-times for the four explosions were correct within 0.0, 0.4, 0.7, and 0.1 sec, respectively. The re-examination shows that the J.B. P tables need a correction of -2.2 ± 1.0 sec for surface epicenters in the mid Pacific and recordings at continental stations. It is confirmed that any difference between the P travel-times from Bikini to Australia and Bikini to the United States is not much more than $\frac{1}{2}$ sec. Previous inferences on the velocities of air waves from the explosions remain undisturbed. The re-examination confirms the occurrence of diffracted PKP waves in front of the 142° caustic, and confirms that these diffracted waves arrive at times significantly earlier than PKIKP waves. (auth)

2079

ELECTROMAGNETIC PROPERTIES OF A WHIRLING STELLAR PLASMA. E. Chvojkova. Byull. Astron. in-tov Chekhoslovakii 8, No. 2, 42-5(1957). (Translated from Referat. Zhur. Fiz. No. 3, 1958, Abstract No. 6687).

The electromagnetic properties formed in a quasi-neutral "whirling" plasma having an excess charge of one polarity, although a small one, are examined. The effects that are capable of reinforcing the magnetic field in such a "whirl" are investigated. Two extreme cases are considered: where the charged particles can penetrate beyond the limits of the "whirl," and when the displacement of the particles is confined to within slight dimensions. In the former case it is possible for radiation to occur within a certain frequency band. In the second case the ends of sufficiently long whirls can acquire, under special conditions, opposite magnetic polarities and opposite charges. On the basis of the theory considered, attempts are made to explain the occurrence of solar activity, radio waves from sunspots, and strong magnetic fields in certain stars.

2080

NUCLEAR ENERGY FOR THE FUSION PROCESS. C. Sanchez Del Río. Energia nuclear (Madrid) 1, No. 2, 19-24(1957) Apr.-June. (In Spanish)

An attempt is made to systematize the problems of controlled thermonuclear reactions and to discuss the possibilities of economic power from fusion processes. (J.S.R.)

2081

EXPERIMENTS ON THE OHMIC HEATING AND CONFINEMENT OF PLASMA IN A STELLARATOR. T. Coor, S. P. Cunningham, R. A. Ellis, et al (Princeton Univ., N. J.). Phys. Fluids 1, 411-20(1958) Sept.-Oct.

The basic concepts of confinement and ohmic heating in a figure-eight stellarator are briefly reviewed and experimental data in these areas summarized. The production of energetic x-rays by runaway electrons, up to ten milliseconds after the disappearance of the accelerating field, has indicated effective single-particle confinement by magnetic fields of 20,000 to 30,000 gauss. However, the plasma confinement time during ohmic heating appears to be limited by unknown processes to approximately 100 microseconds for hydrogen, more than three orders of magnitude shorter than predicted from classical collisional diffusion. The ionization level in a helium discharge, with an initial pressure of about 1 μ of Hg, becomes virtually complete during the heating pulse, and the electric resistivity corresponds to a kinetic temperature of about 100 volts, or 10^6 degrees. After the heating pulse, the electron density decays with a time constant as great as 6 milliseconds under some conditions. The hydromagnetic kink instability predicted by Kruskal has been clearly observed. (auth)

2082

"RUNAWAY" ELECTRONS AND COOPERATIVE PHENOMENA IN B-1 STELLARATOR DISCHARGES. W. Bernstein, F. F. Chen, M. A. Heald, and A. Z. Kranz (Princeton Univ., N. J.). Phys. Fluids 1, 430-7 (1958) Sept.-Oct.

Examination of the temporal distribution, relative intensity, and maximum energy of x-rays about 30 kev emanating from the B-1 stellarator during a pulsed discharge has revealed a number of interesting phenomena. The x-rays are assumed to be produced by "runaway" electrons when they strike the wall. Spuriously large pulse heights have been observed. The x rays abruptly appear early in the discharge, before the Kruskal instability can occur. Depending on the operating conditions, x-rays can be observed at any time during the discharge except when the current is at the Kruskal limiting value. If the longitudinal electric field used for ohmic heating is "crowbarred," x rays can appear afterwards in copious quantities; furthermore, the discharge current can decay in abrupt steps correlated in time with bursts of x rays. The hypothesis that the current in these steps is due entirely to runaway electrons is consistent with the data. These observations are taken to be evidence for the existence of cooperative phenomena, or collective motions which affect both the confinement and the heating of a plasma. In addition, intense nonthermal microwave noise has been detected at times correlated with x-ray emission. (auth)

2083

THE DIVERTOR, A DEVICE FOR REDUCING THE IMPURITY LEVEL IN A STELLARATOR. C. R. Burnett, D. J. Grove, R. W. Palladino, et al (Princeton Univ., N. J.). Phys. Fluids 1, 438-45(1958) Sept.-Oct.

A divertor, designed to reduce the flow of impurities

from the wall into a gas discharge, has been used with a small stellarator. In the divertor an outer shell of magnetic flux is bent away from the discharge channel into a large auxiliary chamber. Ions diffusing toward the wall tend to follow the lines of force of this outer shell into the divertor chamber. Impurities produced by wall bombardment in this chamber do not readily return to the discharge. The magnetic design of this device is described, and a phenomenological theory of its performance is outlined. The spectroscopic data with and without the divertor activated indicate that the divertor reduces the influx of impurities by a factor of two to three, while the impurity concentration at the core, or central region, may be diminished by an order of magnitude when the divertor is activated. Kinetic temperatures of positive ions determined from spectroscopic measurements of Doppler broadening increase from 40 ev without the divertor to 60 ev for He^{+} and to 130 ev for O^{++++} with use of the divertor. (auth)

2084

EXPERIMENTS ON ION CYCLOTRON RESONANCE. T. H. Stix and R. W. Palladino (Princeton Univ., N. J.). Phys. Fluids 1, 446-51(1958) Sept.-Oct.

Theoretical calculations have indicated that an attractive possibility for heating the ions of a plasma directly, swiftly, and efficiently is to feed energy into ion cyclotron waves and cause this wave energy to thermalize. Experiments at the milliwatt power level verify the existence of a resonance in a helium plasma at the cyclotron frequency of the doubly charged helium ion. The variation of the plasma loading with magnetic field strength is markedly asymmetrical, in agreement with the theory of ion cyclotron wave generation. The observed plasma loading indicates an efficiency of power transfer between the induction coil and the plasma greater than 60%. (auth)

2085

INTERFEROMETRIC MEASUREMENT OF ELECTRON CONCENTRATIONS IN PLASMAS. Ralph A. Alpher and Donald R. White (General Electric Research Lab., Schenectady, N. Y.). Phys. Fluids 1, 452-3(1958) Sept.-Oct.

2086

CONFERENCE ON EXTREMELY HIGH TEMPERATURES, BOSTON, MASSACHUSETTS, MARCH 18-19, 1958. Heinz Fischer and Lawrence C. Mansur, eds. New York, John Wiley & Sons, Inc., 1958. 264p.

The conference was sponsored by The Electronics Research Directorate of the Air Force Cambridge Research Center. The conference consisted of four sessions: the production of extremely high temperatures, methods of temperature measurement—optical radiation, plasma analysis, and applications. In the session on production of high temperature papers were included on magnetic acceleration of gas, temperature limits in discharge, exploded wires, arc analysis, inductive energy storage, and high current discharges. In the session on temperature measurement papers were included on equilibrium temperature of a plasma, line broadening theory, microwave thermometer, radiation effects on shock conditions, and radical distribution of photon emitters in symmetric sources. In the session on plasma analysis papers were included on plasma diamagnetism, thermal diffusion, stochastic foundation of generalized macroscopic equations of change in a reacting plasma, plasma motors, the magatron, and a crossed field ionic wind motor. In the session on applications papers were included on, plasma acceleration and generation, thermonuclear propulsion, behavior of materials, and high magnetic fields. (W.D.M.)

CRITICALITY STUDIES

2087 UCRL-5255

California. Univ., Livermore. Radiation Lab. CRITICAL-MASS DETERMINATIONS OF LEAD-REFLECTED SYSTEMS. Robert E. Donaldson and Wilbur K. Brown. June 9, 1958. Decl. Sept. 22, 1958. 10p. Contract W-7405-eng-48. $0.50(OTS).

A series of experimentally determined critical masses of cylindrical and spherical lead-reflected oralloy systems are presented. Critical masses are given for two oralloy core sizes in both cases and also for reflected and unreflected ends in the cylindrical case. Experimental methods are described and a photograph of the assembly machine is included. (auth)

2088

NUCLEAR CRITICALITY. A NOVEL FACTOR IN THE DESIGN AND OPERATION OF CHEMICAL PLANTS. C. M. Nicholls (Atomic Energy Research Establishment, Harwell) and A. H. C. P. Gillieson (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). J. Brit. Nuclear Energy Conf. 3, 302-7(1958) Oct.

A criticality accident with fissile materials could lead to hazards to operators and costly damage to plant. After reviewing briefly the relevant neutron physics, the paper discusses methods for the safe design of geometrically simple, isolated solution systems. It is shown how this can be achieved by limitation of the mass, volume, or concentration of fissile material in solution or, preferably, by selection of the shape of plant. Geometrically complex systems are briefly discussed as are the influence on safety of choice of process and plant operation. (auth)

GEOLOGY AND MINERALOGY

2089 RME-3150

Massachusetts Inst. of Tech., Cambridge. BACKGROUND EFFECTS IN THE INDUCED POLARIZATION METHOD OF GEOPHYSICAL EXPLORATION. Annual Progress Report for 1956-57. Donald J. Marshall, Davis A. Fahlquist, Antonio S. Neves, and Theodore R. Madden. June 28, 1957. 83p. Contract AT(05-1)-718.

The possible causes of the induced polarization properties of rocks have been investigated. Besides the effects of metallic or semiconducting minerals, it is shown that only the diffusion gradients due to varying membrane properties are capable of producing significant effects. Kinetic calculations to study the impedance properties of interfaces show that the ion rearrangements in the solution modify the RC values of the fixed layer associated with metallic electrode-solution interfaces. The calculations are being extended to membrane interfaces. Electrical measurements on igneous and metamorphic rock samples from mining areas have been made. There is an obvious need to extend these measurements to cover many other rock types before correlation with the theory can be undertaken. The modeling approach to studying electromagnetic coupling

is investigated. A major difficulty due to the presence of inductive behavior in the model materials at frequencies above 100,000 cycles is found. Other experimental difficulties exist, but their solution appear straightforward. Only upper limits to the coupling effects could be determined under these difficulties. A theoretical approach to the electromagnetic problem capable of numerical solution is developed. (auth)

2090

SYNTHESIS AND PROPERTIES OF CARNOTITE AND ITS ALKALI ANALOGUES. Paul B. Barton, Jr. (U. S. Geological Survey, Washington). Am. Mineralogist 43, 799-817(1958) Sept.-Oct.

Carnotite and its Na, Rb, Tl, Cs, and H_3O(?) analogs have been synthesized in several different ways in attempts to obtain crystals suitable for single crystal structural investigations. Aqueous methods failed to produce usable crystals, but a simple fusion technique using metavanadate fluxes proved highly satisfactory. Work in progress has shown that carnotite is composed of $[(UO_2)_2V_2O_8]_n^{-2n}$ layers bound together by alkali ions with or without water. Studies of the rate of precipitation of carnotite from aqueous solution as a function of pH suggest that the reaction involves interaction between uranyl, alkali, and metavanadate ($V_4O_{12}^{-4}$) ions, though this is not the only possible interpretation of the data. The x-ray and optical properties of the synthetic compounds are presented. The similarity of the a and b dimensions in metatyuyamunite, sengierite, and the alkali analogs of carnotite shows that the same $[(UO_2)_2V_2O_8]_n^{-2n}$ layer is present in all of these compounds. The Na analog of carnotite is less stable than the other carnotites, and it is not expected that the pure Na variety would occur in nature. (auth)

2091

NOTES ON THE MINERALOGY OF AN YTTRIUM-BEARING PEGMATITE BODY NEAR LAKE GEORGE, PARK COUNTY, COLORADO. Jewell J. Glass, Harry J. Rose, Jr., and Edwin Over. Am. Mineralogist 43, 991-4(1958) Sept.-Oct.

The most abundant yttrium-bearing minerals occurring in the fluorite are allanite, gadolinite, monazite, and xenotime. A description of the fluoride masses and their associated feldspar pegmatite, optical data and mineral identification, and spectrographic analysis is presented. (J.E.D.)

2092

EARTHY MONAZITE AT MAGNET COVE, ARKANSAS. H. J. Rose, Jr., L. V. Blade, and Malcolm Ross (U. S. Geological Survey, Washington). Am. Mineralogist 43, 995-7(1958) Oct.

A general description is presented of an irregular vein, 2 to 8 in. wide, of an earthy, fine-grained, pale greenish-yellow monazite found in extremely weathered portions of an apatite-pyrite vein in the carbonatite of East Tufa Hill, Magnet Cove, Ark. The material was found to be too fine grained for satisfactory measurements. Spectrochemical analysis indicates the material to be mostly monazite with large amounts of cerium earths and phosphorus. (J.E.D.)

2093

DISCOVERY AND EXPLOITATION OF THE ECARPIERE URANIUM DEPOSIT (LOIRE-ATLANTIC). H. Sanselme and J.-C. Zegers. Ann. Mines 624X-48X(1957). (In French)

The discovery and exploitation of the Ecarpière uranium deposits are described. A historical survey is presented, and the methods used in the research and development of the deposits are discussed in detail. (J.S.R.)

2094

A TENTATIVE MEASUREMENT OF RADIOACTIVITY OF HEAVY FRACTION OF UPPER VLTAVA SANDS. Pacal Zdanek. Casopis mineral geol. 2, No. 1, 41-5(1957). (Translated from Referat. Zhur. Khim. No. 3, 1958, Abstract No. 7469.)

The alluvial sands of the Vltava River between Zhelnova and Czechsky Krumlova were studied with the aid of a Geiger counter. The division of fractions was made by a method of magnetic separation. The mineralogical composition of the rocks is Plagioclase 49%, quartz 20%, biotite 18%, amphibole 13%, apatite 0.2%, magnetite 0.1%, titanite 0.04%, zircon 0.02%, orthite traces, and monazite traces. A general increase in activity was noted in the coarse fraction (0.05 to 0.1 mm). The minerals arranged in the order of activity increase, with the PbO content in 10^{-4}% in parentheses, are quartz (5), plagioclase (15), biotite (32), magnetite, amphibole (12), apatite (5), titanite (36), zircon (40), optite, and monazite. The average activity corresponds to amphibole. The spectrographic composition is given. (J.S.R.)

2095

THE GEOCHEMICAL CYCLE OF URANIUM. L. C. García de Figuerola. Energia nuclear (Madrid) 1, No. 2, 59-64(1957) Apr.-June. (In Spanish)

The cycle of petrogenesis is discussed in general, and then the uranium cycle is considered as a special case. (J.S.R.)

2096

THE WATER, DEUTERIUM, GAS AND URANIUM CONTENT OF TEKTITES. Irving Friedman (U. S. Geological Survey, Washington). Geochim. et Cosmochim. Acta 14, 316-22(1958) Oct.

The water content, deuterium concentration of the water, total gas and uranium contents were determined on tektite samples and other glass samples from Texas, Australia, Philippine Islands, Java, French Indo-China, Czechoslovakia, Libyan Desert, Billiton Island, Thailand, French West Africa, Peru, and New Mexico. The water content ranges from 0.24 per cent for the Peru tektite, to 0.0002 per cent for a moldavite. The majority of the tektites have less than 0.05 per cent water, and average 0.005 per cent H_2O by weight. No other gases were detected, the lower detection limit being about 1 p.p.m. by weight. The deuterium content of the water in tektites is in the same range as that in terrestrial waters, and varies from 0.010 mole per cent to 0.0166 mole per cent deuterium. The uranium content is about from 1 to 3 p.p.m. The possible origin of tektites is discussed. The experimental data presented favor their being originally terrestrial, but produced by some catastrophic event. An extra-terrestrial source is not ruled out. (auth)

2097

ISOTOPIC COMPOSITION OF LEAD FROM TEKTITES. G. R. Tilton (Carnegie Inst. of Washington). Geochim. et Cosmochim. Acta 14, 323-30(1958) Oct.

The isotopic composition of lead in three tektites and Libyan Desert glass is compared with that in known terrestrial and extra-terrestrial sources. The lead contained in the glasses is similar to modern terrestrial lead, particularly lead from modern oceanic sediments. The uranium, thorium, and lead concentrations

were determined for one of the glasses, an australite. Evidence is given which indicates that within the last tens of millions of years differentiation of uranium, thorium, and lead occurred in the parent material of the australite. These results are difficult to explain in terms of any extra-terrestrial origin involving fusion of materials from the moon, meteorites or comets, but they are readily explained if tektites are of terrestrial origin involving fusion of argillaceous sediments in some unspecified way. (auth)

2098

Sr/Rb AGE STUDY OF TEKTITES. W. H. Pinson, Jr., L. F. Herzog, H. W. Fairbairn, and R. F. Cormier (Massachusetts Inst. of Tech., Cambridge). Geochim. et Cosmochim. Acta 14, 331-9(1958) Oct.

Eight tektite samples from four localities, Australia, Indo-China, the Philippines, and the Moldau Valley were analyzed for Rb and Sr, and Sr isotopic composition analyses were made on seven of the samples. Seven of the eight samples are so similar in Rb/Sr ratios that a common source origin is postulated for the tektites. No radiogenic Sr^{87} was found in the tektites. All have normal 84/88, 86/88, and 87/86 ratios, namely, 0.0068, 0.1193, and 0.712. It is shown that the present Rb/Sr and Sr isotopic composition data are compatible (but unlikely) with an origin of tektites as differentiated from either proto-basaltic or achondritic material. The tektites could not have differentiated from chondritic material. Other than indicating a common and homogeneous source origin for the tektites, the present data are not evidence for or against an extra-terrestrial origin. However, the homogeneity in Rb/Sr contents and the constancy of the Sr^{87} contents make a terrestrial origin difficult to accept because of the wide geographical distributions of tektites. (auth)

2099

THE PRINCIPLE TYPES OF URANIUM AND THORIUM ORES. Manuel Alía Medina. Energía nuclear (Madrid) 1, 59-66(1957) Jan.-Mar. (In Spanish)

A brief survey is presented of the different types of uranium and thorium ores, and the most important deposits of each type are indicated. The chemical and physical characteristics which determine the types of deposits are discussed. (J.S.R.)

2100

THE Sr^{90} CONTENT OF VARIOUS SOILS IN THE FEDERAL TERRITORY AND IN WEST BERLIN. Erwin Welte (Biologischen Bundesanstalt für Land- und Forstwirtschaft, Berlin-Dahlem) and Albert Sittkus (Univ. of Freiburg i. Br.). Naturwissenschaften 45, 463-4(1958). (In German)

To obtain the measurement of the extent of the poisoning resulting from the frequency of atomic bomb explosions, the Sr^{90} content of 22 permanent land soils and of the vegetation associated with them was determined in 1957. The results are tabulated. (J.S.R.)

2101

THE U.S. POSITION AS TO RESOURCES FOR THE HIGH TEMPERATURE METALS. Richard M. Foose. Stanford Research Inst. J. 2, 56-63(1958).

Information is presented on world and domestic resources and production of columbium (niobium), tantalum, molybdenum, tungsten, and chromium. The survey indicates that molybdenum is the only high-temperature metal with which the United States has a fully satisfactory position. (J.H.M.)

2102

GEOLOGIC FEATURES OF AREAS OF ABNORMAL RADIOACTIVITY SOUTH OF OCALA, MARION COUNTY, FLORIDA. Gilbert H. Espenshade. U. S. Geol. Survey Bull. 1046-J. 1958. 18p. and 4 illus. Available from U. S. Government Printing Office, Washington, for $1.00.

Areas of abnormal radioactivity south of Ocala, Marion County, Fla., were investigated by surface examination and by 10 power-auger drill holes. Interbedded clay, clayey sand, and uraniferous phosphorite occur in the areas of anomalous radioactivity. Miocene fossils occur at 3 localities in these beds which are evidently outliers of Miocene sedimentary rocks on the Ocala limestone of Eocene age. The preserved outliers are southwest of the main belt of Miocene sedimentary rocks. The principal uraniferous rocks are clayey, sandy, pellet phosphorite that occurs in beds a few feet thick, and very porous phosphatic sand rock that makes abundant float at many places. Apatite forms the phosphate pellets in the unweathered phosphorite. The very porous phosphatic sand rock is the highly leached residuum of the pellet phosphorite and is composed mainly of quartz, kaolinite, wavellite, and crandallite (pseudowavellite). It closely resembles the aluminum phosphate rock of the "leached zone" of the Bone Valley formation of Pliocene age in the land-pebble phosphate district. (auth)

2103

SELECTED ANNOTATED BIBLIOGRAPHY OF THE URANIUM GEOLOGY OF IGNEOUS AND METAMORPHIC ROCKS IN THE UNITED STATES. Diane Curtis. U. S. Geol. Survey Bull. 1059-E. 1958. $0.55.

This bibliography consists of 117 references concerned with the uranium content and radioactivity of igneous and metamorphic rocks and minerals in the United States including Alaska and Hawaii. The annotations, arranged alphabetically by author, emphasize the geologic features of rocks and minerals for which uranium determinations have been made. An index map shows the location of igneous and metamorphic rocks and minerals that have been analyzed chemically for uranium. Indexes are provided with entries listed according to author, geographic area, and subject. (auth)

HEALTH AND SAFETY

2104 AECU-3904

General Mills, Inc., Minneapolis.

UPPER ATMOSPHERE MONITORING PROGRAM. Quarterly Report Covering Period February 1, 1958 thru June 30, 1958. Report No. 1884. Sidney Stern, Lee Torgeson, Stephen Rohrbough, Bruce Johnson, Carl Peterson, and Rex Wood. Nov. 7, 1958. 51p. Project No. 89125. Contract AT(11-1)-401. $9.30(ph OTS); $3.60(mf OTS).

An investigation was made of the parameters involved in the collection of air particulates by fibrous filter beds in order to design an optimum balloon-borne sampling device. This report details collection efficiency of IPC fibrous filter mats for submicron particulates for a wide range of velocities at two stratospheric altitudes. The collection of particulates by a fibrous filter mat in the diffusion regime is treated in detail. A semi-empirical equation which expresses collection efficiency in terms of the physical parame-

ters of the fibrous mat has been found to agree satisfactorily with experimental data. The collection efficiency of isolated fibers by a diffusion process has also been studied and an equation derived which considers convective effects. Agreement between theory and experiment is found to be satisfactory. In order to relate dpm per cubic foot at altitude to dpm per standard cubic foot, it is necessary to have quite accurate density measurements. Three physical methods which have been laboratory tested are described. A new direct flow particulate sampler has been tested environmentally and flown successfully. It is anticipated that this unit with some modification will replace present equipment. (For preceding period see AECU-3781.) (C.H.)

2105 AERE-HP/R-2606

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

RELATION BETWEEN MEASUREMENTS OF DEPOSITED ACTIVITY AFTER THE WINDSCALE ACCIDENT OF OCTOBER 1957. A. C. Chamberlain. Sept. 1958. 19p. $0.35(BIS).

The measurements made at Windscale of gamma dose rate and of I^{131} activity in grass, soil, and milk have been examined and the interrelations between them worked out. The activity of I^{131} per unit area of ground, deduced from gamma dose rate, is in good agreement with that found by direct measurement of samples in the laboratory. (auth)

2106 NP-7068

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

STUDY OF BLAST EFFECTS IN SOIL. Final Report. M. A. Chaszeyka and F. B. Porzel. Aug. 1, 1958. 119p. ARF Project No. D119. Contract DA-44-009-ENG-3113.

The blast effects from prepositioned atomic and thermonuclear demolition munitions were investigated, with emphasis on the characteristics and magnitudes of cratering, ground shock, and associated air shock phenomena as a function of depth of burial, stemming, partial confinement, and air spaces surrounding the charge. The influence of soil type, moisture content, density, void ratio, and other soil characteristics on the propagation of the blast wave was studied. Basic theories of blast wave propagation are reviewed and applied to determinations of the characteristics of a blast wave in idealized mixtures of air and incompressible solid, various types of rhyolite tuff, soft and hard rocks, clay, sand, and ice. (C.H.)

2107 NP-7069

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

STUDY OF BLAST EFFECTS IN SOIL. Report No. 5. M. A. Chaszeyka and F. B. Porzel. May 1, 1958. 35p. ARF Project No. D119. Contract DA-44-009-eng-3113.

The pressures generated by a nuclear detonation on the walls of the chamber in which it is detonated are estimated by employing equations of state for air, reflection theory and extrapolation of the blast wave pressure-distance curve in the surrounding soil to higher pressures. The effect on the blast wave of increasing the air space surrounding the charge is to increase the available blast wave energy at large distances. Effect of partial confinement on a nuclear detonation by a chamber and adjoining tunnel is evaluated by determining the relative rate of energy propagation into soil and air in the chamber, and then combining these results with the correlation of the propagation of shock waves from a spherical nuclear detonation in air with the propagation of a plane shock wave in the tunnel. The conclusion derived from this evaluation is that the length of unstemmed straight tunnel required to reduce the peak pressure to indestructive levels from a nuclear detonation of the kiloton size inside a tunnel, is too large to be practical. The propagation of a blast wave from a one kiloton nuclear detonation in a spherical chamber of one meter radius in reddish rhyolite tuff is analyzed. The results are compared with a similar analysis on white rhyolite tuff. These rhyolite tuffs are volcanic rocks of different physical characteristics and are found in the Nevada Test Site Area. The reddish tuff has a density of 1.9 gm/cm^3; the white tuff density is 1.7 gm/cm^3. The comparison illustrates the relative effect of soil properties on blast wave attenuation. The analysis includes heating effect, cavitation and effect of partial stemming. The excellent properties of ice and snow for attenuating blast waves are discussed. An experiment conducted in the Antarctic is cited, which illustrates the waste heat concept and has important implications on the seismic effects of nuclear underground detonations. (auth)

2108 RM-2108(RAND)

RAND Corp., Santa Monica, Calif.

GRAPHICAL METHODS FOR THE QUANTITATIVE PREDICTION OF CLOSE-IN FALLOUT. Joseph B. Knox. Jan. 31, 1958. 127p. (AFSWP-1074).

The quantitative prediction of close-in atomic fallout in middle latitudes is formulated as an initial-value problem. At the time of stabilization of the atomic cloud, certain initial conditions must be known concerning the active debris such as the initial distribution of radioactive material with respect to particle size, and the initial distribution of radioactive particle size in space. In addition, the fall velocity of this particulate matter as a function of particle size must be known. To predict the ground positions of this debris, a simple dynamic model of the atmosphere is employed to compute the evolution of the horizontal wind that transports the debris during its fall to the earth's surface through the mobile atmosphere. This dynamical model is designed to include the effect of orography on the evolution of the horizontal wind field; the filtering approximation employed in the dynamical model is a non-diverging wind field computed directly from the initial horizontal wind field. A case study of the prediction of close-in atomic fallout is presented as an illustration of the application of the prediction model and numerical-graphical techniques of integration. (auth)

2109 TT-776

OBSERVATIONS OF RADIOACTIVE CLOUDS FROM ATOMIC TESTS IN RELATION TO ATMOSPHERIC TRANSPORT AND EXCHANGE PROBLEMS. (Beobachtungen an Radioaktiven Schwaden von Atomtechnischen Versuchen im Hinblick auf Atmosphärische Transport- und Austauschprobleme). A. Sittkus. Translated by D. A. Sinclair (National Research Council of Canada) from Beitr. Physik Atmosphäre 30, 200-206(1958). 13p.

Regular measurements have been made since 1953, at Freiburg, West Germany, of the long-lived radioactive materials contained in rain water. In 1953 when a series of atomic bomb tests took place in the Nevada desert, U.S.A., a travelling time of 10 to 20 days was

determined for the resulting atomic cloud. The shortest time for arrival of an atomic cloud was five days. The influence of intermixing of fission products from different tests on the measurements is discussed. The Freidburg measurements showed that the products of the hydrogen bomb tests in the Marshall Islands reached West Germany after a travel time of 10 to 20 days. In general the systematic use of the decay law did not yield discrete explosion times but only quite indistinct distribution curves which indicate approximately the true explosion dates. The effects of meteorological conditions of both the troposphere and the stratosphere on the transport, exchange, and deposition of fission products is discussed. (C.H.)

2110

USE OF A GAMMA RAY SPECTROMETER FOR INVESTIGATION OF PLUTONIUM CONTAMINATED WOUNDS. E. A. Putzier, J. R. Mann, and V. P. Johnson (Dow Chemical Co., Denver). Am. Ind. Hyg. Assoc. J. 19, 384-5(1958) Oct.

A gamma-ray spectrometer was used to estimate the amount of plutonium in wounds by measuring the x rays from plutonium-239. Good agreement was obtained between in vivo measurements before and after excision and alpha particle analysis of the excised tissue. (C.H.)

2111

ZIRCONIUM. I. HYGIENIC STANDARDS. II. SIGNIFICANT PROPERTIES. III. INDUSTRIAL HYGIENE PRACTICE. IV. SPECIFIC PROCEDURES. V. LITERATURE REFERENCES. Am. Ind. Hyg. Assoc. J. 19, 446-7(1958) Oct.

The hazards of acute and chronic exposure to zirconium dust are reviewed. Industrial hygiene practices are outlined. 13 references. (C.H.)

2112

RADIATION DOSE REDUCTION IN DENTAL ROENTGENOGRAPHY. Lewis E. Etter (Univ. of Pittsburgh); S. S. Sidhu (Argonne National Lab., Chicago); and L. C. Cross (Veterans Administration Hospital, Pittsburgh). Am. J. Roentgenol. Radium Therapy Nuclear Med. 80, 926-32(1958) Dec.

It is evident that one of the largest sources of imperfectly controlled radiation emanates from dental roentgen-ray machines. This is because they are operated at relatively low kilovoltages and current values for long times of exposure, with no diaphragming of the beam or filtration of it, short focal-film distances and, often, by using standard, relatively slow films. This overdosage can be corrected by employing at least 2 mm Al filtration in the present machines in addition to a lead disphragm and ultra-speed film. To take full advantage of known physical principles in reducing radiation exposure, higher kilovoltage dental roentgen-ray machines capable of developing 90 or better kv with current capacities of 15 to 20 ma, timers accurate to $^1/_{20}$th of a second, long-cone techniques, and fastest films are recommended. (auth)

2113

WORK WITH RADIOACTIVE PAINTS. Ferdinand Konecny. Bezpecn. a hyg. prace 7, No. 8, 231-4(1957). (Translated from Referat Zhur. Khim. No. 5, 1958, Abstract No. 15002).

To obviate the possibility of irradiation of the hands of workers who apply radioactive paints (RP) containing Ra, MsTh, and Sr^{90}, the jar of RP (not more than 1.5 g of luminous composition per container) must be placed within a 3 mm Pb shield. Work with RP is carried out in a special exhaust enclosure with transparent walls and a slot for the hands. The air velocity is 0.5 meter per second. The paint is applied with glass rods and the use of brushes is prohibited. The finished articles are dried in chests where the velocity of the air-draft suction is 1 to 1.5 sec at the door. The establishment is provided with decontamination locker-rooms which are divided into contaminated and clean sections. As a hand cleanser a mixture of 25% trichlorethylene, 25% xylene, and 50% ethyl alcohol is recommended, which is followed by washing with soap and water. Requirements as to conditions of work-areas and equipment are set forth, and the necessity of efficient safety engineering and strict adherence to rules of individual hygiene is emphasized.

2114

GENERAL IDEAS ON THE IMPORTANCE OF POWDER CONTAMINANTS IN NUCLEAR PLANTS. Emilio Iranzo González. Energia nuclear (Madrid) 1, No. 4, 46-58(1957) Oct.-Dec. (In Spanish)

Atmospheric contaminants from diverse industrial operations constitute a major health problem, especially in plants where work is done with radioactive materials. The various methods used to collect air samples in such plants are described in detail. (J.S.R.)

2115

RADIATION PROTECTION. Carl B. Braestrup and Harold O. Wyckoff. Springfield, Ill., Charles C Thomas, 1958. 374p.

Potential hazards for man resulting from developments in nuclear energy are reviewed. A summary is presented of the present knowledge of radiation protection. The material is presented in a manner understandable to professional people who are not specialists in the field. The material is applicable to the training of radiological defense groups. (C.H.)

2116

LEITFADEN FÜR RADIOAKTIVITÄT UND STRAHLENSCHUTZ. (Manual for Radioactivity and Radiation Protection.) Nicolai Grigor'evich Gusev. Translation of "Spravochnik po Radioaktivnym Izlucheniyam i Zashchite." Berlin, VEB Verlag Technik, 1957.

The essential information on the physical properties of radioactive materials and their radiations is compiled. The question of radiation protection is especially considered. The fundamentals of atomic physics are briefly discussed. The maximum permissible doses recommended in the literature for internal and external irradiation are reviewed. A detailed discussion is presented on protection against gamma radiation and the bremsstrahlung from betatrons. Quantitative indications on the absorption coefficient of a narrow gamma radiation beam, self-absorption of gamma rays in extensive radiation sources, quantitative indications on alpha and beta particles, and gamma radiation of radioactive elements are briefly considered. (J.S.R.)

INSTRUMENTS

Refer also to abstract 2611.

2117 AERE-Med/R-2643

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

MONITORING FOR CARBON MONOXIDE AND CARBON DIOXIDE. A. Holmes. Aug. 1958. 25p. $0.70(BIS).

A discussion of existing CO and CO_2 monitoring methods is presented along with a brief summary of health aspects of these gases. A selected method using an infrared gas analyzer for instantaneous and continuous monitoring of either gas is described. (J.R.D.)

2118 BNL-3838
Brookhaven National Lab., Upton, N. Y.
A TWO-DIMENSIONAL KICKSORTER WITH MAGNETIC DRUM STORAGE. Robert L. Chase. [1958]. 16p. $3.30(ph OTS); $2.40(mf OTS).

The kicksorter accepts coincident pulse pairs and tallies them in storage locations whose addresses are determined by the height of both pulses. There are 3072 storage locations arranged in a 96 × 32 matrix on a high speed magnetic drum. Serial binary arithmetic is used with each storage location having a capacity of 16 binary bits. Single pass reading and writing is used to reduce the memory access time. Head and amplifier paralysis problems are avoided by storing successive bits in a given channel on different magnetic tracks. Four channels of temporary address storage are employed which reduces the average memory access time to 1250 microseconds with a 6000 RPM drum. The two address coordinates are obtained using conventional height-to-time conversion techniques. Except for the cathode ray tube display section the instrument is completely transistorized. (auth)

2119 CML-TN-P108-16
Chicago. Univ. Chicago Midway Labs.
THE CHANNELED, SHAPED-SCREEN IMAGE INTENSIFIER. J. Burns and M. J. Neumann. July 31, 1958. 21p. Contract AF18(603)-9. (AFOSR-TN-58-756; AD-201615).

The present status of the channeled, shaped-screen intensifier may be summarized as follows: the principle offers certain characteristic advantages over other types of intensifiers, the chief ones being resolution independent of the number of stages, low voltage operation with the attendant possibility that background levels will be low, and the possibility, depending on design requirements of the photocathode, that the screens can be made to support the atmospheric pressure on thin faceplates, making the construction of large-area tubes a possibility. Thus far a dynode design has been devised which has yielded gains per stage equal to about 75% of the secondary emission ratio of the dynode surface at a design voltage of 400 volts per stage on a five-stage tube having 25-mesh dynodes. It appears that the problem of finding a suitable interscreen insulation for finer mesh dynodes can be solved by the use of glass enamel; however, it remains to be seen whether this kind of insulation causes any noise or background difficulties. The problem of making fine mesh screens of the proper shape also appears well on its way toward a successful solution. The production of uniform, stable, high-yield secondary emission surfaces on these screens by evaporation of thin films of Mg followed by oxidation is progressing, but has not reached the desired state or reproducibility at this writing. The design of the photocathode and first dynode is still at an early stage, but two designs have been evolved which seem to merit closer study. The successive reduction in scale of the multiplier has reached the 50 to 65-mesh level. The background level and noise characteristics of the multiplier have not yet been measured, but series of tubes in the 50 to 65-mesh scale presently under construction should provide a good indication as to what may be expected in this respect in still smaller-scale multipliers. (auth)

2120 GAT-T-544
Goodyear Atomic Corp., Portsmouth, Ohio.
FOUR EXPERIMENTAL RESIN COATED CONDENSERS. F. A. Koehler. Oct. 10, 1958. 4p. Contract AT(33-2)-1. $1.80(ph OTS); $1.80(mf OTS).

Four condensers were resin coated under relatively ideal conditions. Two, RC-123 and RC-125, have been installed in the cascade. The other two are ready and will be installed when the opportunity arises. There are indications that the resin coated condenser tubes do not foul as readily as the bare copper tubes. Hence, the coated condensers may, in the long run, have better heat transfer. The tests on these coated condensers should provide this information. The actual life of a resin coated condenser is estimated to be several years. No further work on resin coated condensers is contemplated. (auth)

2121 HW-39823(Rev.1)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
TECHNICAL SPECIFICATIONS FOR URANIUM COLORIMETERS. G. J. Alkire. Dec. 3, 1956. 6p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

2122 NP-7011
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
EFFECT OF VISCOSITY ON FLOW MEASUREMENTS WITH TURBINE-TYPE FLOWMETERS (thesis). Fred William Rohr. Jan. 1957. 83p.

The turbine-type flowmeter performance was evaluated using fluids of various specific gravities and viscosities and using varied flow conditions. The flow rate was varied from 0 to 60,000 lb/hr. The effect of fluid viscosity was investigated by tests at a constant temperature of 80°F and a variation of fluid viscosity from 1 to 115 centistokes. The performance was evaluated by study of non-dimensional parameters and by development of empirical equations to represent the calibration curves. It is suggested that the most important parameter affecting calibration is viscosity. (J.R.D.)

2123 PL/N-3
Academia R. P. R. Institutul de Fizică Atomică, Bucharest.
L'ACTION DU pH SUR L'EFFICACITÉ DE LA FORMATION DE L'IMAGE LATENTE DANS LES ÉMULSIONS NUCLÉAIRES. (The Effect of pH in the Efficiency of Latent Image Formation in Nuclear Emulsions). M. Nicolae. 1958. 10p.

In the process of fabrication and development and in the stability of the latent image, pH plays an essential role. Experiments were made to determine the effect of pH on the sensitivity of nuclear emulsions and to show that a variation of the sensitivity is reversible. The pH limits between which there is an reversible and an irreversible variation of the sensitivity were established. (J.S.R.)

2124 SCR-56
Sandia Corp., Albuquerque, N. Mex.
AC/DC DIRECT-READING VOLTAGE CALIBRATOR. Robert E. McCalium. [Issued] Nov. 1958. 23p. Contract AT(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

Presented at Instrument Society of America, 13th Annual Instrumentation-Automation Conference and Exhibit, Philadelphia, Sept. 1958.

The application of several basic electrical principles to the development of a voltage calibrator which is direct reading in measuring either d-c or a-c voltages is discussed. The direct-reading feature is made possible by a unique arrangement of a voltage divider used with d-c voltage references. A thermal converter and accessory circuits are incorporated for a-c measurements. The ideas are applicable either to the construction of portable calibrators or to measurements utilizing laboratory apparatus. With a portable calibrator, the accuracy of d-c measurements was approximately 0.1% from 1100 v to 1.0 v, decreasing to approximately 0.25% at 0.1 v; a-c measurements at 1 kc have been made from 1 v to 750 v with approximately 0.25% accuracy. (auth)

2125 WADC-TR-57-374(Pt. IV)
National Bureau of Standards, Washington, D. C.
PHYSICAL PROPERTIES OF HIGH TEMPERATURE MATERIALS. PART IV. THERMAL DIFFUSIVITY APPARATUS FOR 100° TO 1,500°C. [Period covered] April 1, 1956 to August 31, 1957. Howard W. Flieger, Jr. and Defoe C. Ginnings. Oct. 1957. 13p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: THERMAL MEASUREMENTS. Contract AF33(616)-56-21.

An apparatus has been designed and constructed for measuring diffusivities up to about 1500°C. Values of thermal conductivity may be derived from thermal diffusivity values using density and heat capacity values. The apparatus was designed for measurements on materials having thermal diffusivity values less than 0.1 cm^2/sec, such as most refractory oxides at moderate to high temperatures. A radial heat flow method is used, heating the outside of a cylindrical sample at a constant rate and measuring the resulting radial temperature difference. Preliminary tests at moderate temperatures have indicated satisfactory performance in both precision and in ease of operation. The apparatus will be used to measure thermal diffusivities of certain ceramic materials which seem suitable as standards. (auth)

2126 AEC-tr-3273
THE PRESENT DAY MICROANALYSER WITH ELECTRONIC SOUNDING. R. Castaing. Translated for Westinghouse Electric Corp. Bettis Atomic Power Div. from p.300-4 [of] Proc. Intern. Conf. Electron Microscopy, 3rd Conf., London, 1954. Royal Microscopical Society. 1956. 10p.

The microanalyzer described makes use of the principle of spot chemical analysis by means of x-ray spectrography. A section of a surface of a specimen is subjected to electron bombardment. Its x-ray emission in the characteristic ray of one of its constituents A is compared with the x-ray emission of the pure element A, in the same ray and under the same conditions of bombardment. The relationship of the two intensities is equal, in the first approximation, to the mass concentration of the element A in the region under analysis. (A.C.)

2127 AEC-tr-3484
THE ELECTRIC MASS FILTER AS A MASS SPECTROMETER AND ISOTOPE SEPARATOR. W. Paul, H. P. Reinhard, and U. von Zahn. Translated by John F. Burns (Oak Ridge Gaseous Diffusion Plant) from Z. Physik. 152, 143-82(1958). 66p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 15703.

2128 NP-tr-156
THE MASS SPECTROMETER AND SOME CHEMICAL APPLICATIONS. J. Kistemaker. Translated by J. B. Sykes (U.K.A.E.A. Atomic Energy Research Establishment) from Kosmos (Swed.) 26, 73-84(1948). 15p.

A description of the principles and operation of the mass spectrograph is presented. In addition, chemical applications of the spectrograph, such as analysis of gas from continuous processes, analysis of organic gases and vapors, impurity detection in gases, determination of ionization and dissociation energies, and tracer work with stable isotopes, are discussed. (J.R.D.)

2129 NP-tr-179
A CONTRIBUTION TO THE THEORY OF TRANSMITTING TRIODES, CONSIDERING FINITE TRANSIT TIMES. Friedrich Huelster. Translated for (U.K.A.E.A. Atomic Energy Research Establishment) from Arch. Elektr. Übertrag. 9, 207-20(1955). 46p.

The electronic processes in a transmitting triode, considering finite transit times, are examined in order to predict operating characteristics such as output, cathode loading, etc. After a critical review of methods and information available up to now, and the presentation of general relationships, the convection and induced currents and their fundamentals are determined for the control space for Class B operation, by a graphic method. The results allow the processes in the power-extraction space to be predicted, using already known methods, and thus allow the operation of the whole valve to be completely described. (auth)

2130 SCL-T-206
A SOIL TEMPERATURE PROBE WITH ELECTRO-THERMAL COMPENSATION. (Pochvennyi termoshchup elektroteplovoi kompensatsii). D. P. Vasilishin. Translated by Marcel I. Weinreich (Sandia Corp.) from Meteorologi. i Gidrologi. 12, 44-5(1957). 6p.

Design characteristics are described of a soil temperature probe with electrothermal compensation. (C.H.)

2131 TT-777
THE DESIGN PRINCIPLES OF INSTRUMENTS FOR MONITORING RADIOACTIVITY AND DETAILS OF THE MONITORING NETWORK OF THE GERMAN METEOROLOGICAL SERVICE. (Grundsätzliches Über die Konstruktion der Geräte zur Radioaktivitäts-Überwachung und Einzelheiten des Netzes des Deutschen Wetterdienstes). Max Hinzpeter. Translated by D. A. Sinclair (National Research Council of Canada) from Beitr. Physik Atmosphäre 30, 207-10(1958). 7p.

A monitoring network of 10 stations was established in 1955 by the German Meteorological Service. Measurements were made of the specific beta activity of the air near the surface, beta activity of the precipitation, and gamma radiation when the activity exceeds a certain value. The measuring procedures and instruments employed are described. (C.H.)

2132
EFFECT OF MAGNETIC STRAY FIELD ON THE LOCATION OF IMAGE IN NUCLEAR SPECTROMETERS. I. Berkes (Central Research Inst. for Physics, Hungarian Academy of Sciences, Budapest). Acta Phys. Acad. Sci. Hung. 9, 13-21(1958).

In case of sectorial magnetic fields the location of the image shifts from the geometrically calculated position because of a fringing field. The lateral displacement was calculated. This was compensated for in actual

measurements by altering the field intensity. The calculated alteration of field intensity was checked experimentally. (auth)

2133

APPLICATION OF THE HERSCHELL EFFECT FOR SELECTIVE ERASING OF BACKGROUND IN NUCLEAR EMULSION. Lucjan Jarczyk and Zbigniew Lewandowski (Jagellonian Univ., Cracow). Acta Phys. Polon. 15, No. 2, 143-5(1956). (Translated from Referat. Zhur. Fiz. No. 2, 1958, Abstract No. 2807.)

To improve the visibility of various nuclear phenomena in photographic emulsions against a large background due to gamma radiation, use is made of the Herschell effect. The emulsions were filled with lithium and irradiated by a stream of slow neutrons from a radium source (dose of gamma quanta was 2×10^{11} photon/cm^2 of emulsion). The emulsions were then exposed to a 300-watt incandescent lamp with an infrared filter and developed in amidol at a pH < 6.4. The density of the grains in the tracks of the particles and of the tritons obtained from the $Li^6(n,\alpha)T$ reaction was studied along with a number of grains of the background in a unit volume as a function of the exposure time to the infrared rays. Similar experiments were made with tracks of α particles from thorium C′. The analysis of the experimental data shows that the Herschell effect improves the visibility of the tracks against a strong background of gamma rays. There exists an optimum dose of infrared rays, depending on the type of the observed particles. The quantity η/η_0(η is the ratio of the effect to the background when exposed to rays and η_0 the effect without exposure), corresponding to the optimum removal of the background, changes with the ionizing ability of the particles.

2134

THE OPTICS OF COSMIC RAY TELESCOPES. Ernst-Åke Brunberg (Royal Inst. of Tech., Stockholm). Arkiv Fysik 14, 195-262(1958).

The directional properties of cosmic ray telescopes are analyzed with regard to both geomagnetic deflection of the primary particles and to the spread in the atmosphere of the secondaries. The concepts "image of a cosmic ray source" and "polar diagram of a telescope outside the earth's magnetic field" are introduced. Image of a cosmic ray source is defined as the intensity variation recorded by a telescope during one day. The polar diagram represents the sensitivity of a telescope for different angular positions of a cosmic ray source element on the celestial sphere. A few examples of calculating polar diagrams are given. The resolving power of cosmic ray telescopes is discussed. (auth)

2135

PROPORTIONAL COUNTERS IN X-RAY SPECTROCHEMICAL ANALYSIS. T. Mulvey and A. J. Campbell (Associated Electrical Industries Ltd., Aldermaston, Berks, Eng.). Brit. J. Appl. Phys. 9, 406-10(1958) Oct.

Proportional counters have been used as spectrometers in experiments in nuclear physics for some time, but their general application to problems of x-ray analysis has been delayed partly for technical reasons and partly through lack of information. Existing theories on the proportional counter are reviewed in order to determine the fundamental limits of resolving power when used as a spectrometer for light elements such as magnesium. A survey of experimental results indicates that only a slight further improvement in performance is required to enable proportional counters to analyze adjacent elements such as magnesium and aluminum, thus allowing one to dispense with an analyzing crystal. (auth)

2136

EVALUATION OF RESULTS IN MAGNETIC FIELD MEASUREMENTS BY NUTATION METHOD. A. I. Zhernovoi, Yu. S. Egorov, and G. D. Latyshev (Obraztsov Leningrad Inst. of Transportation). Izvest. Akad. Nauk. S.S.S.R. Ser. Fiz. 22, 988-92(1958) Aug. (In Russian)

The results indicate that the method is efficient for absolute measurements of fields with sharply defined gradients. Freedom from the effects of the outer field intensity makes it useful in absolute measurements of very weak fields. (R.V.J.)

2137

INDUSTRIAL PHOTOELECTRON MULTIPLIERS WITH IMPROVED RESOLVING TIME AND HIGH CURRENT YIELD. A. G. Berkovskii, L. G. Leiteizen, and V. G. Pol'skii. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 1002-4(1958) Aug. (In Russian)

Performance descriptions and specifications are given of a new thirteen-cascade multiplier designed for investigations of nuclear processes separated by very small intervals of time. (R.V.J.)

2138

DATA ON MANUFACTURED AND NEW TYPE PHOTOELECTRON MULTIPLIERS FOR SCINTILLATION SPECTROMETERS. A. G. Berkovskii, I. Ya. Breido, et al. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 1005-8 (1958) Aug. (In Russian)

Data are presented on the various photomultipliers manufactured in the USSR, and descriptions are given for new small-size and miniature multipliers for scintillation spectrometers. (R.V.J.)

2139

PROPERTIES OF A THERMOELECTRIC CELL. G. M. Grover, D. J. Roehling, and E. W. Salmi (Los Alamos Scientific Lab., N. Mex.) and R. W. Pidd (Univ. of Michigan, Ann Arbor). J. Appl. Phys. 29, 1611-12 (1958) Nov.

A gas-filled diode is proposed as a useful device for the direct conversion of heat energy into electrical energy. A vacuum diode operated with no applied voltage developed an electromotive force between the two electrodes, which was dependent, among other things, on the temperature difference of the electrodes. The hot electrode was electrically positive with respect to the cold collector. When an external load resistor was joined to the electrodes, the characteristic cell currents were of the order of one μa per cm^2 of emitting surface for electrode spacing of the order of one cm. The addition of a very small amount of easily ionized gas such as cesium vapor into the cell container changed the cell characteristics drastically. The cesium vapor had little effect on the developed emf. The cell impedance was lowered by many orders of magnitude. A rough colorimetric determination indicates an efficiency of about 5% at peak power output. The results of the investigation are shown graphically. (A.C.)

2140

AMPLITUDE SELECTOR WITH ONE CHANNEL. W. L. Buys (Univ. of Gand, Belgium). J. phys. radium 15, 582(1954). (In French)

The design of an amplitude selector with well-defined discrimination thresholds for rapid pulses is described. The minimum resolution time is 1 μ sec, and the stability is very good. The circuit is utilized with proportional and scintillation counters. (J.S.R.)

2141

A CORROSION PROOF VACUUM CONTROLLER FOR PRESSURES UNDER 1 mm OF MERCURY. I. Amariglio and M. M. Benarie (Israel Ministry of Defence, Tel-Aviv). J. Sci. Instr. 35, 385(1958) Oct.

A vacuum controller designed for pressures of less than 1 mm Hg is described. The pressure-sensitive element is an inclined Toepler arrangement. The image of the liquid level in the manometer is projected on a gas-filled photocell which controls a servomotor. A glass leak valve is positioned by the servomotor. (J.R.D.)

2142

BF_3 COUNTERS. J. J. Beauval, S. Dousson, and P. Prugne (Centre d'Études Nucléaires, Saclay, France). Le vide No. 69, 208-14(1958) May-June. (In French)

Because of the increasing necessity of the detection and measurement of thermal neutrons, the Centre d'Études Nucléaires of Saclay has perfected a method for making BF_3 counters. A detailed description for making and filling these counters is given. The device used for testing the counters is also described, and the characteristics of the counter are discussed. (tr-auth)

2143

AN IMPROVED WILSON CHAMBER APPARATUS FOR MEASURING THE SCATTERING OF BETA RADIATION. J. Allewaert and J. Verhaeghe (Univ. of Gent, Belgium). Mededel. Koninkl. Vlaam. Acad. Wetenschap. Belg. 15, No. 12, 11p. (1953). (In Dutch)

A detailed description of the design and construction of an automatic pair cloud chamber is presented. The electronic control, the illumination system, and the photographic apparatus are also described. (J.S.R.)

2144

DESCRIPTION AND CALIBRATION OF A BETA SPECTROMETER WITH DOUBLE FOCUSSING. THE BETA SPECTRUM OF Cs^{137}. J. Demuynck and J. Verhaeghe (Univ. of Gent, Belgium). Mededel. Koninkl. Vlaam. Acad. Wetenschap. Belg. 16, No. 11, 21p. (1954). (In Dutch)

A detailed description is given of the design of a double-focusing beta spectrometer. The focusing conditions are derived, and the equations of the magnetic field are given. The standardization of the electronic measuring system and the field measurements are discussed. The conversion spectrum of Cs^{137} was measured with this spectrometer. (J.S.R.)

2145

PROPOSAL FOR AN ANALOG-TO-DIGITAL ELECTRONIC CONVERTER SUITED FOR NUCLEAR PULSE HEIGHT ANALYSIS. A. Alberigi, C. Bernardini, and I. F. Quercia. Nuclear Instr. 3, 201-3(1958) Oct.

An analog-to-digital converter is proposed based on the use of delay lines as codifying elements. Application of the converter to pulse height analyzers, with one or more channels, is discussed. Preliminary experimental work is briefly reported. (auth)

2146

FAST RING COUNTER AS ELECTRONIC SWITCH. Wolfgang Gruhle (Max Planck-Institut für med. Forschung, Heidelberg, Ger.). Nuclear Inst. 3, 204-6(1958) Oct. (In German)

An improved ring counter is described which can be extended to any number of stages. The use of modern switching tubes allows counting rates up to 1 Mc/s, every stage giving separate output pulses without loading effect on the cycling process. For program switching application more than one state may simultaneously pass around the ring. (auth)

2147

CHOICE OF COLLIMATORS FOR A CRYSTAL SPECTROMETER FOR NEUTRON DIFFRACTION. G. Caglioti, A. Paoletti, and F. P. Ricci (Comitato Nazionale per le Richerche Nucleari, Rome). Nuclear Instr. 3, 223-8(1958) Oct.

Some criteria are established for the choice of the collimators for a crystal spectrometer for neutron diffraction in order to achieve a good compromise between luminosity and resolution. General expressions for the full width at half maximum and for the luminosity of the diffraction peaks are developed for powder sample. The advantage of the parallel arrangement is also computed. (auth)

2148

INTERNALLY REFLECTING ČERENKOV COUNTER FOR HIGH ENERGY PROTONS. N. E. Booth, F. L. Hereford, and G. W. Hutchinson (Univ. of Birmingham, Eng.). Nuclear Instr. 3, 229-32(1958) Oct.

A high energy proton detector is described, which utilizes multiple internal reflections of Čerenkov radiation to achieve a sharp energy threshold. The detector is capable of accepting a charged particle beam of cross section comparable to that of the radiator. A preliminary version of the counter has been studied experimentally in the 500–900 Mev proton energy range. The performance of the detector agrees with that expected, when allowance is made for various factors which limit the resolution. (auth)

2149

NEW TYPE OF ANGULAR-DISTRIBUTION CHAMBER. R. L. Clarke (Atomic Energy of Canada, Ltd., Chalk River, Ont., Can.). Nuclear Instr. 3, 233-6(1958) Oct.

A chamber to be used in the observation of charged particles from nuclear reactions is described. This chamber allows observations to be taken over the continuous range −25° to +145° with respect to the incident beam without opening the vacuum system. (auth)

2150

ADVANCES IN NUCLEAR ELECTRONICS. EXPERTS MEET IN PARIS AFTER GENEVA CONFERENCE. Denis Taylor and G. D. Smith. Nuclear Power 3, 530-4 (1958) Nov.

A report on the 87 papers presented at the International Symposium on Nuclear Electronics organized by the French Société des Radio-Electriciens is presented Over 400 scientists and engineers met in Paris to discuss current practices and techniques in nuclear electronics. (W.D.M.)

2151

LIQUID SCINTILLATION COUNTING FOR TRITIUM AND CARBON-14. C. P. Haigh. Nuclear Power 3, 585-7(1958) Dec.

Problems involved in measuring low-energy beta emitters by liquid scintillation counters and their future applications in science and medicine are outlined. Scintillating solutions, a suspension technique, applications in tracer work, and future developments are discussed.

A schematic is included of a single-channel counter that uses an EMI 13-stage photomultiplier type 9514S followed by an electronic amplifier with a maximum gain of X 1000. (J.H.M.)

2152

SCALING AND COINCIDENCE CIRCUITS. B. Collinge (Liverpool Univ.). Nuclear Power 3, 595-7(1958) Dec.

The operating principles and uses of scaling and coincidence circuits are discussed. Dekatron, trochotron, and conventional scalers and fast circuits are described. Also included is the application of these circuits to isotope techniques. (J.H.M.)

2153

THE BASIC DESIGN DATA OF A GUARDED-FIELD THIMBLE IONIZATION CHAMBER: A PRECISION IONOMETRIC INVESTIGATION. L. A. W. Kemp and Barry Barber (London Hospital Research Labs.). Phys. in Med. and Biol. 3, 123-37(1958) Oct.

A new type of cavity ionization chamber is described, which eliminates the need for the conventional collecting peg with the associated electrode asymmetry and non-uniform electrostatic field distribution. The new chamber provides a true cylindrical cavity in which the collecting electrode is a disk coplanar with one end of the cavity, the disk being surrounded by a guard surface of appropriate width. Parallelism of the collecting field terminating on the collecting electrode is ensured by subdividing the cylindrical cavity wall into equal-width annuli evenly graded in potential between earth and the full polarizing voltage, the latter being applied to the end surface of the cavity opposite the collecting electrode. Some advantages of the new type of chamber in cavity ionization research and high energy radiation dosimetry are discussed, and the basic design data are given. (auth)

2154

THE MAIN PROBLEMS OF DESIGNING SELF-COMPENSATING RADIOACTIVE DENSIMETERS FOR LIQUIDS. K. S. Furman. Priborostroenie No. 5, 22-4(1958).

The theoretical aspects of density determinations from a measurement of the decrease of the intensity of a gamma source irradiating a liquid are discussed in detail. Two Soviet devices which utilize this principle for density measurements are described. (J.S.R.)

2155

SECOND-ORDER PROPERTIES OF DOUBLE-FOCUSING SPECTROMETER WITH NONUNIFORM MAGNETIC FIELD. Hidetsugu Ikegami (Univ. of Tokyo). Rev. Sci. Instr. 29, 943-8(1958) Nov.

Second-order focusing properties are considered for a nonuniform magnetic field with arbitrary circular boundaries in the case of normal entry and exit. The formula obtained here agrees with that obtained by Hintenberger for the special case $\alpha = \beta = 0$. It is also shown that the double and second-order focusing can be achieved simultaneously. The numerical results are represented graphically for a symmetrical double-focusing spectrometer with an arbitrary deflection angle. (auth)

2156

ALPHA-PARTICLE IRRADIATION APPARATUS. Edwin J. Hart and John Terandy (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 29, 962-5(1958) Nov.

An apparatus having up to four Po^{210} sources suitable for radiation chemistry studies in liquids is described. Each unit consists of a source and housing that supplies a collimated beam of α particles, a variable speed stirrer, and an irradiation cell holder. Energy output is measured with the ferrous sulfate dosimeter. (auth)

2157

PORTABLE MAGNETIC FIELD AND GRADIENT METER. W. C. Thoburn (Iowa State Coll., Ames). Rev. Sci. Instr. 29, 990-2(1958) Nov.

A portable instrument for measuring magnetic fields and field gradients is described. The measurements depend on comparing the alternating emf's induced in two search coils oscillated synchronously at about 3 cps through angles of less than 3°, one in the field to be measured and the other in the reference field of a permanent magnet in the instrument. A precision Helipot is used as a potentiometer, in which a measured fraction of the signal from the reference coil is balanced against the signal from the probe coil. The null is obtained through an electronic amplifier and galvanometer. Tests of the instrument indicate 0.1% precision. A field gradient can be measured with the same instrument by use of a search coil which is given translatory oscillations in the direction of the gradient. (auth)

2158

PREPARATION OF THIN ANTHRACENE SINGLE CRYSTALS. H. Kallmann and M. Pope (New York Univ.). Rev. Sci. Instr. 29, 993-4(1958) Nov.

Anthracene single crystals ranging in thickness from 4 to 80 μ and from 0.5 to 2 cm^2 in area have been prepared by crystallization from a selected solution system. The method is general and employs a density and temperature gradient within the solution which permits the crystal to grow while suspended in the solvent. (auth)

2159

GAMMA-RAY RESOLUTION OF LARGER NaI(Tl) SCINTILLATORS. R. L. Hickok and J. E. Draper (Yale Univ., New Haven). Rev. Sci. Instr. 29, 994-9(1958) Nov.

The various factors affecting the gamma-ray energy resolution of NaI(Tl) scintillation spectrometers have been investigated experimentally with commercially packaged 2.5- and 5-in. diam scintillators and routinely available 3- and 5-in. photomultipliers. The resolution contains contributions from the scintillator light yield, photocathode efficiency, intrinsic resolution due to the material NaI(Tl) and two terms involving the effects of various spatial inhomogeneities in the packaged scintillator and photomultiplier. Insofar as possible these contributions are experimentally separated. The poorer resolution of the 5-in. systems is in about equal measure caused by their smaller light yield, their larger spatial inhomogeneities and the lower efficiency of the 5-in. photomultipliers in producing and collecting cathode electrons. (auth)

2160

MAGNETIC ANALYZER FOR NUCLEAR REACTION PRODUCTS. Otto Meier, Jr., N. R. Fletcher, W. R. Wisseman, and R. M. Williamson (Duke Univ., Durham, N. C.). Rev. Sci. Instr. 29, 1004-8(1958) Nov.

A magnetic analyzer for nuclear reaction products has been built which employs a sector-shaped uniform magnetic field. The shaped sectors are inserted in the 8.5-in. gap of a C-shaped magnet with a 12 × 12 in. cross section. The iron core is 54 × 33 in., and 69,360 ampere-turns give 13,500 gauss across a total air gap of $1\frac{5}{8}$ in. In the notation of W. G. Cross, [Rev. Sci.

Instr. 22, 717, (1951)], the parameters were: $\rho = 15$ in., $\phi = 60°$, useful gap = 1.5 in., $l' = 22.5$ in., $l'' = 45$ in., $\epsilon_1 = +46°38'$, $\epsilon_2 = -18°21'$, max usable $\alpha = \pm 3°$, max usable $\omega = \pm 1.6°$. The entrance boundary was straight, and the exit boundary had a convex curvature of 123.7 in. The boundaries of the sector and the locations of the object and image positions were corrected for the effect of the fringing field. The observed l'' was 46.5 in. Fringing field focusing in the direction perpendicular to the plane of deflection was not as strong as calculated; the maximum image height was 2 in. The magnet is capable of bending 12-Mev protons and has an energy resolution of 300 for the maximum useful solid angle of 1/2000 of 4π steradians. The observed maximum energy resolution was 400. The advantages of this magnet are simplicity of construction and ease of adaptation to other sector parameters. (auth)

2161

PALLADIUM FILM DOSIMETER. H. M. Childers (American Machine & Foundary Company, Alexandria, Va.). Rev. Sci. Instr. 29, 1008-10(1958) Nov.

A PdO film electrical resistor, mounted on an insulating base and surrounded with a hydrogenous material, has been investigated for use as a neutron dosimeter. It was found that the resistance of such film was lowered from several thousand to a few ohms upon being irradiated either in a reactor or in a pure gamma-ray field. The cause of this resistance change was determined to be the evolution of hydrogen gas during irradiation, which reduced the PdO to Pd. The potential use of this device as a total dose dosimeter is discussed. (auth)

2162

CONVECTION FREE INSTRUMENT FOR MEASURING INFRARED RADIATION IN THE ATMOSPHERE. Roger L. Aagard (Univ. of Minnesota, Minneapolis). Rev. Sci. Instr. 29, 1011-16(1958) Nov.

The instrument described is a null type device which measures the equivalent blackbody radiation temperature in the atmosphere at night by supplying electrical power to the absorber surface to replace the net loss of energy by radiation and keep the surface at the ambient air temperature. Thus convection effects are eliminated. A thermopile is used to detect the absorber surface temperature difference from air and provide a signal to the high gain transistor d-c amplifier of the servo system. Apparatus is also described which was useful in the development of the instrument and in verifying its theoretical calibration. (auth)

2163

ELASTIC CONSTANT–INTERNAL FRICTION SPECTROMETER. D. O. Thompson and F. M. Glass (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 29, 1034-40(1958) Nov.

An elastic constant-internal friction spectrometer has been developed which has proved to be very useful in measurements which must last over extended periods of time as well as in measurements which require a high degree of resolution. The essential feature of the spectrometer is the fact that it holds the sample in oscillation at its resonance frequency and at a preset strain amplitude, and measures the internal friction of the sample through a measurement of the driving force necessary to maintain the preset amplitude. (auth)

2164

FEEDBACK COHERENCE CONTROL FOR SUPER-REGENERATIVE SPECTROMETERS. C. Dean (Univ. of Pittsburgh). Rev. Sci. Instr. 29, 1047(1958) Nov.

By utilizing the gain through a feedback control of the quench rate it is possible to considerably broaden the rf bands that can be covered without manual readjustment. A 30 to 45-Mc self-quenched super-regenerative spectrometer incorporating this principle is described. (A.C.)

2165

DEPENDENCE OF SCINTILLATION COUNTER RESOLUTION ON SHAPE OF LIGHT PULSE AND ANODE TIME CONSTANT. J. E. Draper and R. L. Hickok (Yale Univ., New Haven). Rev. Sci. Instr. 29, 1047-8 (1958) Nov.

2166

DIFFUSION CLOUD CHAMBER WORKING AT HIGHER TEMPERATURES. P. Teunissen and S. Wijnnobel (Technical Univ., Delft, Holland). Rev. Sci. Instr. 29, 1051-2(1958) Nov.

A diffusion cloud chamber is described which dispenses with dry ice as a refrigerant. Satisfactory results were obtained with the bottom being kept at about 15°C and the cover at about 100°C. The gas filling was air at atmospheric pressure; 27 liquids were used as vapor sources. Further investigations of the behavior of these liquids in a diffusion cloud chamber are in progress. (A.C.)

2167

COUNTING LOSSES CAUSED BY THE STATISTICAL PROPERTY OF PHOTOEFFECTS IN 4π SCINTILLATION COUNTERS FOR β EMITTERS. M. Yu. Tissen. Zhur. Tekh. Fiz. 28, 1617-20(1958) July. (In Russian)

The relative counting losses in 4π scintillation counters are calculated considering that photoelectron emissions can be described by Poisson formulas. The results are presented as a graph for the case of allowed β spectrum. The approximate formula for calculation of counting losses, suitable for mean and large Z, is included. The results obtained for a counter with two coincidence multipliers are in good agreement with experimental data. (tr-auth)

2168

RADIOISOTOPE LABORATORY TECHNIQUES. R. A. Faires and B. H. Parks. London, George Newnes Limited, 1958. 252p.

A practical guide to the laboratory use of radioisotopes is presented. The terminology may be easily understood by workers having only basic scientific knowledge. The theory of nuclear physics is reviewed briefly. Design features and equipment for radiation laboratories are discussed. Electronic techniques are discussed and radiation detection equipment and techniques are described. Applications of isotopes are reviewed. (C.H.)

METALLURGY AND CERAMICS

2169 AECU-3864

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

ACTIVITIES IN LIQUID AND SOLID METAL SYSTEMS. Progress Report on Research Program [for] February 1, 1958 to January 31, 1959. John F. Elliott. Oct. 21, 1958. 9p. Contract AT(30-1)-1888. $1.80(ph OTS); $1.80(mf OTS).

Brief summaries of the experimental work being done on the phase distribution in Fe–Ni–Pb, Fe–Ni–Pb–C,

and Fe–Ni–C systems at 1350 to 1550°C are presented. In addition, activities in the Al–Ag–Pb, Mn–Fe, and Mn–Fe–Pb systems at 700 to 1100°C were investigated. Results are represented graphically. (J.R.D.)

2170 AECU-3877
Case Inst. of Tech., Cleveland.
GEOMETRIC DEPENDENCE OF MAGNETIC ANISOTROPY IN THIN IRON FILMS. Technical Report No. 3. Thomas G. Knorr and R. W. Hoffman. Sept. 1958. 68p. Contract AT(11-1)-623. $10.80(ph OTS); $3.90(mf OTS)

Thin iron films produced by vacuum deposition are observed to display a magnetic anisotropy dependent on the geometric location of the evaporating filament. A fiber axis structure is induced during the evaporation. If the direction of incidence of the metallic flux varies from a normal to the substrate this fiber axis tilts in a similar direction. As soon as the fiber axis is no longer normal to the plane of the film, magnetic anisotropy is produced. The variation of the tilt of the fiber axis correlates with and can be shown to account for the geometric dependence of the observed anisotropy. Calculations of the magnetic anisotropy expected in a film with a fiber axis structure and an anisotropic tensile stress in the plane of the film agree with the experimental observations for those films which show only rotational switching. Anisotropies of 3×10^4 ergs/cm^3 were observed in iron films about 350 A thick prepared without the use of applied magnetic fields either during deposition or during a subsequent thermal anneal. (auth)

2171 AECU-3882
Stanford Research Inst., Menlo Park, Calif.
REACTIONS OF METALS WITH OXYGEN AND STEAM. Quarterly Report No. 5, (Report No. 15) for July–September 1958. Fred E. Littman and Franklin M. Church. Oct. 22, 1958. 6p. For Oak Ridge National Lab. SRI Project No. SD-2116. Contract [7405-eng-26]. [Subcontract 1088]. $1.80(ph OTS); $1.80(mf OTS).

The autoignition limits of Zircaloy-2 and -203 were investigated using foil and rods, under static and dynamic conditions. The results were marked by an unusual variability, Zircaloy-2 rods ignited at pressures as low as 650 psi of oxygen, but sometimes failed to ignite at 1500 psi. Zircaloy foil ignited at pressures above 750 psi of oxygen under static conditions. Under dynamic conditions, autoignition occurred at pressures as low as 50 psi, but at other times did not occur up to 500 psi. The reasons for this erratic behavior are not known for certain, but indications are that it is caused by minute variations in the composition of the material, which alter some physical characteristic of the metal (such as brittleness). Because of this lack of reproducibility, variation of the autoignition limits with oxygen concentration have not been reliably established. The importance of changes in surface-to-volume ratios is also obscured by this lack of reproducibility. At this time attempts are being made to overcome this by using very large changes in the ratios. (auth)

2172 AECU-3883
Massachusetts Inst. of Tech., Cambridge.
DEFORMATION AND FRACTURE OF METALS AT ELEVATED TEMPERATURES. Final Technical Report for the Period January 1, 1957 to September 30, 1958. Arup R. Chaudhuri and Nicholas J. Grant. Oct. 30, 1958. 15p. Contract AT(30-1)-1973. $3.30(ph OTS); $2.40(mf OTS).

Specimens of aluminum–magnesium alloy were prestrained, and the creep behavior of the alloy was studied in subsequent tests. In addition, aspects of creep deformation and fracture of aluminum–zinc alloys were studied along with intercrystalline fracture of this alloy. A summary of experimental methods, materials used, and conclusions is presented. (J.R.D.)

2173 AGARD-157
North Atlantic Treaty Organization, Paris. Advisory Group for Aeronautical Research and Development.
FATIGUE AND AGEING. F. Bollenrath. Nov. 1957. 23p.

This Report was presented at the Sixth Meeting of the Structures and Materials Panel, held from 4th to 8th November, 1957, in Paris.

In addition, mention is made of the interaction between rates of diffusion and strain. From this are derived the resonance frequencies corresponding to the temperatures present during vibrational strain. (auth)

2174 BM-RI-5423
Bureau of Mines.
CHEMICAL AND GALVANIC CORROSION PROPERTIES OF TITANIUM ALLOYS. Charles B. Kenahan and David Schlain. Mar. 1958. 31p.

The chemical and galvanic corrosion properties of commercially pure titanium, a titanium–manganese alloy, a titanium–aluminum–tin alloy, 2 titanium–copper alloys, and 2 titanium–aluminum alloys were studied. Tests were conducted in synthetic ocean water, tapwater, 1% sodium hydroxide, 5% ferric chloride, 5% ammonium sulfate, various concentrations of sulfuric and hydrochloric acids, and 1% oxalic acid. All tests were carried out at 35 or 60°C, with a flow of air or helium. Dissimilar metals involved in galvanic-couples experiments were aluminum, magnesium, and stainless steel. Electrode-potential measurements on single (uncoupled) specimens were also measured. Commercially pure titanium and the titanium-base alloys were generally quite similar in their resistance to corrosion, whether alone or in contact with a dissimilar metal. Contact with the titanium metals caused aluminum and magnesium to corrode by galvanic action. Coupling with stainless steel in sulfuric acid solutions decreased the normal corrosion rate of the titanium metals. Contact with aluminum in air-aerated oxalic acid and 0.1N sulfuric acid solutions resulted in cathodic corrosion of titanium and the titanium-base alloys; however, there were a few exceptions. The copper alloys showed better corrosion characteristics than titanium in certain sulfuric acid solutions but were more susceptible to chemical attack in some hydrochloric acid solutions. (auth)

2175 BMI-1259
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING MARCH 1958. Russell W. Dayton and Clyde R. Tipton, Jr. Apr. 1, 1958. Decl. July 18, 1958. 64p. Contract W-7405-eng-92.

The thermal conductivity and electrical resistivity of U encapsulated in Zircaloy-2 with NaK as a heat transfer material were determined prior to irradiation. The short-time rupture strength of 15% cold-worked Zircaloy-2 at 290, 345, and 400°C is reported. Tests to develop the right-angle method of extrusion cladding of U with Al were continued. Pressure bonding of Al to Ni-plated U by temperature and gas-pressure techniques has produced sound metallurgical bonds. A series of 17 alloy compositions was prepared for corrosion testing

in an effort to develop a natural-uranium fuel alloy with improved corrosion resistance. A study of the oxidation of UO_2 was continued. The corrosion of stainless steel by chloride-contaminated nitric acid solutions is reported. Studies are reported on the solidification of unalloyed U ingots. A study of the reactions that may occur during the induction melting of U is reported. Specimens of enriched UN or UC dispersed in stainless steel and clad with stainless steel were investigated to determine tensile properties at elevated temperatures and resistance to irradiation damage. Electrical resistivity and tensile strength measurements were made on UO_2-stainless steel cermets at room temperatures. Work has continued on the investigation of hydrides of U–Zr alloys as fueled moderators. Investigations of the radiation stability of U–Zr alloys is presented. Corrosion data are reported on gamma-phase uranium alloys. The preparation of U–Nb alloys is described. Oxidation data on Nb and Nb alloys tested in dry air at 1000 and 1200°C are reported and discussed. Degassing experiments at 450 to 650°C were successfully performed on Nb–H_2, permitting calculation of diffusion coefficients. Diffusion coefficients for hydrogen in delta zirconium hydride are given. The use of Ti as a construction material continues to appear promising for both dissolver and the feed adjustment tank for the Darex process. Limited evidence indicates the Al additions may be more suitable than thorium additions for controlling corrosiveness of initial Thorex solutions. The effects of sodium exposure on the creep behavior of tantalum are reported. The high-temperature mechanical properties and weldability of tantalum are presented. Pressure-bonding studies of plate-type UO_2 fuel elements continued. Casting techniques are presented for UC. Data are given on the effect of processing variables on bulk density of sintered UO_2 pellets. (For preceding period see BMI-1256.) (W.L.H.)

2176 BMI-1267

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING MAY 1958. Russell W. Dayton and Clyde R. Tipton, Jr. June 1, 1958. Decl. June 18, 1958. 58p. Contract W-7405-eng-92.

Thermal-conductivity measurements of unirradiated UO_2 were started. The creep and rupture strengths of 15% cold-worked Zircaloy-2 were determined at 290, 345, and 400°C. Corrosion testing of high-strength zirconium alloys with Nb and Mo additives at 300°C is in progress. Centrifugal-casting studies of air-melted Al–25 wt. % U extrusion billets are described. Optimum time-temperature-pressure relationships were determined for hydrostatic pressure bonding of nickel-plated uranium slugs in aluminum sheaths. Development of a high-uranium fuel alloy that has improved corrosion resistance in 300°C water was undertaken. Studies concerned with radiation stability of U–Zr alloys, the development of gamma-phase U alloys, and the mechanism of aqueous corrosion are presented. Fatigue studies of Inconel and INOR-8 are in progress. A study is presented of the oxidation behavior of unalloyed Nb and Nb alloys with the objective of correlating the oxidation behavior of the metal with the effects of alloying on a fundamental basis. An investigation of the effects of cation valence of solute additions upon the stability of UO_2 is in progress. Dry-friction and sodium-lubricated tests were completed using a Mo–Mo rubbing combination. An investigation is in progress with the purpose of analyzing the pressure-bonding process from the standpoint of the creep properties of the material involved. A study of the kinetics and mechanisms of the reaction of H_2 with Nb was made. Experimental and theoretical study of the mechanism of H_2 migration in zirconium hydride has continued. Titanium continues to have merit for use as a material of construction of the Darex dissolver and feed-adjustment tank. The evaluation of various metals for use as container materials for the dissolution step of a proposed Sulfex-Thorex process has continued. Materials for the construction of the hydrofluorinator in the fluoride volatility process are being tested. Investigations of the creep behavior of Ta in Na in an inert atmosphere (He) and a study of factors concerned with the welding of Ta are presented. Studies of mixing in a flow model of the PWR were continued. Pressure bonding of Zircaloy-2-clad fuel elements containing compartmented oxide fuel plates are being evaluated for use in PWR Core 2. The evaluation of UC as a reactor fuel is continuing. Evaluation of various fuel materials for the Nuclear Merchant Ship Reactor is presented. (For preceding period see BMI-1262.) (W.L.H.)

2177 BMI-1294

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING SEPTEMBER 1958. Russell W. Dayton and Clyde R. Tipton, Jr. Oct. 1, 1958. Decl. Oct. 31, 1958. 51p. Contract W-7405-eng-92. $9.30(ph OTS); $3.60 (mf OTS).

Thermal-conductivity and electrical-resistivity measurements made on a U–1.5 wt. % Zr alloy surrounded by NaK enclosed in a Zircaloy-2 capsule were in poor agreement with measurements made directly on a U–1.5 wt. % Zr specimen. Several short-time rupture tests on Zircaloy-2 were completed at 400°C. Thermal-conductivity measurements were started on UO_2 specimens. Research to develop a method of sink-float density measurements to identify factors affecting irradiation-induced volume changes in graphite was continued. High-purity Mo single crystals are being prepared for irradiation-damage studies. Centrifugal-casting techniques are being investigated for the production of Al–35 wt. % U alloy. The manner in which U solidifies in cylindrical molds is being studied. Two methods, electroless plating and vapor plating, of preparing a protective coating of Mo on Croloy $2\frac{1}{4}$ are being investigated. Experimental work was continued to determine the effects of various oxide additions on the oxidation behavior of UO_2. The investigation of fueled moderators for possible use in gas-cooled reactors has continued with the measurement of hydrogen-absorption isotherms for the Zr–25 wt. % U alloy, and preliminary work on high-temperature x-ray-diffraction studies. The damage produced in type 347 stainless steel by exposure to fast-neutron flux of 3×10^{15} nv and to integrated flux levels of about 16×10^{22} nv was investigated. The properties of Nb–U alloys are being studied. The improvement of the irradiation stability and corrosion resistance of Th–U alloy through alloy additions was investigated. Gas-pressure bonding of Mo- and Nb-clad fuel elements is being investigated. Fatigue studies on Inconel and INOR-8 continued. The effect of forming pressure on green density of UC was established. The fabrication and irradiation of UO_2-containing graphite spheres are reported. All experiments conducted with Ti exposed to Darex solutions continue to indicate that this metal will serve as a material of construction of the dissolver and for the feed-adjustment system. The study of various heat treat-

ments designed to improve the resistance of Carpenter 20 Cb and of Ni-o-mel to Sulfex and Thorex solutions is still in progress. Studies have indicated that corrosion is promoted by an increased HF flow in the fluoride-volatility process. The irradiation study of UC for the SRE is continuing, and two capsules of specimens are undergoing examination in the hot cells. The effects of irradiation on the strength and ductility of tantalum were investigated. Further mixing studies were made in the PWR flow model, and results are reported for mixing on the inlet and the outlet sides of the reactor core. Pressure-bonded Zircaloy plates containing UO_2 fuel were evaluated. An investigation of the effects of irradiation on clad graphite specimens in a CO_2 environment for the Maritime Gas Cooled Reactor is reported. Development of various types of fuels for the Nuclear Merchant Ship Reactor is described. (For preceding period see BMI-1286.) (W.L.H.)

2178 BNL-3825

Brookhaven National Lab., Upton, N. Y.

NEUTRON DIFFRACTION INVESTIGATION OF A POSSIBLE FERRO-ANTIFERROMAGNETIC PHASE TRANSITION IN Mn_2Cr_3Sb. S. J. Pickart and R. Nathans. [1958]. 2p. $1.80(ph OTS); $1.80(mf OTS).

For presentation at Conference on Magnetism and Magnetic Materials, Nov. 17-20, 1958, Philadelphia, Penna.

The solid solutions of antiferromagnetic CrSb and ferromagnetic MnSb are characterized by unusual magnetic susceptibilities, and a phase change from the antiferromagnetic to the ferromagnetic state may occur. Room-temperature patterns of MnSb show that the layers of Mn spins are ferromagnetically coupled, and in addition, have the spin along the c direction. Room-temperature data on $Mn_{0.2}Cr_{0.8}Sb$ confirm that this material is antiferromagnetic, its structure being of the CrSb type, and exclude any nuclear ordering of the Mn and Cr atoms on the lattice positions. At liquid helium temperature the neutron data exhibit a number of weak additional lines, the main group of reflections remaining essentially unchanged. The smallest unit cell on which these additional peaks can be indexed requires that the axis be tripled. While it is doubtful that the extra peaks are sufficient to obtain a unique spin structure, their very appearance would seem to rule out the suggestion of Latgering and Gorter that the Mn spins acting independently of the Cr are responsible for the ferromagnetism. Such behavior should result in short-range order, in view of the fact that the Mn atoms are not ordered on the crystallographic positions and are not likely to become so at the Curie point (Ca 170°K). On the other hand, Hirone and Adaschi have suggested an angular arrangement of spins with a magnetic unit cell the same as given by the neutron data. If this model is correct, and the deviation from the CrSb structure is small, the extra reflections would be expected to be weak and the fundamental diffraction peaks to be changed only slightly. (auth)

2179 DMIC-106

Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.

BERYLLIUM FOR STRUCTURAL APPLICATIONS. A REVIEW OF THE UNCLASSIFIED LITERATURE. Webster Hodge. Aug. 15, 1958. 181p. Contract AF18(600)-1375. (AD-201103; PB-121648).

A summary of available information on beryllium including recent data which may aid in evaluating its usefulness as a structural material in airframe and missile applications is presented. The literature references include data on sources of ore and the production, fabrication, properties, and applications of the metal. The problems in industrial hygiene encountered in working with beryllium and its compounds are reviewed briefly. (auth)

2180 HW-55689

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

URANIUM FROM ORE TO FUEL ELEMENTS. R. E. Olson. Apr. 11, 1958. 32p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The general processing steps that are involved in preparing the fuel for Hanford reactors are described. The eight-step process for obtaining metallic U in suitable form for use in an atomic reactor is described. (auth)

2181 HW-55958

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE EFFECT OF REACTOR ATMOSPHERE ON ZIRCONIUM AND ZIRCONIUM ALLOYS. R. G. Wheeler. May 6, 1958. 13p. Contract W-31-108-Eng-52. $0.50 OTS).

Zirconium, Zircaloy-2, and Zircaloy-3b specimens were exposed to a 50 vol. % helium–50 vol. % carbon dioxide reactor atmosphere at a weighted average temperature of 430°C for a total of 886 days at temperature. Either the irradiation, or some constituent in the gas, appears to reduce the rate of reaction above 450°C primarily by delaying the inception of break-away corrosion. Any initial strength advantage in the materials tested obtained by cold work would soon be lost at temperatures above 400°C because the cold worked specimens were fully annealed by their exposure. The specimens suffered no significant change in ductility or mechanical strength other than that attributable to annealing. (auth)

2182 HW-57814

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CLAD SPLITTING IN DEFECTIVE ZIRCALOY-2 CLAD URANIUM FUEL ROD. G. T. Geering and D. C. Worlton. Oct. 16, 1958. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Twenty-two Zircaloy-2 clad uranium fuel rods were coextruded. These rods were part of a first attempt to produce integral end seals in rods with 0.030 inch clad and 0.630 inch outer diameter. Five rods developed clad blisters during beta heat treatment. After several months of storage at room temperature the cladding over one blister ruptured. Two other blisters increased in size. Ultrasonic tests confirmed that no metallurgical bond exists in the blistered regions. Ultrasonic test maps show that the size of the unbonded areas has increased with time. A loose black powder was found under the blister which ruptured. X-ray diffraction analysis identified UO_2 and UN as components of the powder. The evidence strongly suggests that air entered the extrusion billet. The corrosion product so formed exerts a force on the cladding which can cause blisters and eventual clad splits. Improvements in billet design appear to have eliminated clad blistering in coextrusions with integral end seals as well as in coextrusions without end seals. (auth)

2183 ISC-977
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN METALLURGY FOR JULY–DECEMBER 1957. Aug. 15, 1958. 101p. Contract W-7405-eng-82. $2.50(OTS).

The separation of ThO_2 and C from $ThCl_4$ by vacuum sublimation is described. Three methods for the preparation of YF_3 by the direct hydrofluorination of high purity Y_2O_3 for the production of Y metal is presented. The preparation of V metal by the iodide process and by the reduction of V_2O_5 is presented. The preparation of Nb metal by the reduction of Nb_2O_5 with Cu, Mg, and Al and by the iodide process is discussed. The preparation of Th by the iodide process and by the Reduction of ThF_4 with Ca–Mg is described. The solubility of U in zinc and the thermodynamic properties of U_2Zn_{17} was investigated. The preparation of a series of Y–Th alloys is reported. A phase diagram and thermodynamic properties are given for a Zn–Zn alloy. The solubility of thorium hydride in thorium was determined from 300 to 800°C. Lattice constants are given for V–Cr alloys. Phase studies are reported in the Al–V and Zr–Ni alloys. The physical properties of $CaMg_2$ and $MgCu_2$ were investigated. The effects of impurities on the allotropy of Ca was investigated. The elastic constants of single crystals of several Cu–Ni alloys were determined at room temperature using the pulse-echo technique. The low temperature properties of V metal were investigated. The reaction of Ba with $CaCl_2$ is being studied at 900°C. The distribution coefficient for Ag between liquid Pb and liquid Zn at 500°C was determined from 0.01 wt. % Ag in Zn to 0.7 wt. % Ag in Zn. The mechanical working properties of Y metal were investigated by cold-rolling, hot rolling, and swaging methods. Vapor pressure measurements were performed over Ca, Mg, and Ca–Mg alloys. The oxidation of Y–Ti alloys and their behavior in high temperature water was studied. (For preceding period see ISC-903.) (W.L.H.)

2184 KAPL-M-JMG-4
Knolls Atomic Power Lab., Schenectady, N. Y.
MECHANICAL PROPERTIES OF JOINTS IN OXIDE DISPERSION FUEL ELEMENTS BRAZED WITH 70 Mn–30 Ni ALLOY. J. M. Gerken. Sept. 28, 1956. 16p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The application of 70 Mn–30 Ni alloy to brazed end closure for S2G fuel reload was investigated and compared with results obtained using 60 Mn–40 Ni braze. It was concluded that the two brazing alloys are equivalent, and the 70 Mn–30 Ni does not embrittle with age as does the 60 Mn–40 Ni alloys. (J.R.D.)

2185 NAA-SR-2704
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ALUMINUM-ELECTROCLADDING STUDIES FOR PROPOSED OMR FUEL ELEMENTS. G. V. Alm and M. H. Binstock. Oct. 1, 1958. 44p. Contract AT-11-1-GEN-8. $1.25(OTS).

Dense, adherent claddings of aluminum up to 25 mils thickness were produced on nickel-plated uranium cores by electrodeposition. A continuously regenerative etheral bath containing lithium hydride and aluminum chloride was used. Metallurgical bonding of a aluminum electrocladdings to nickel-plated uranium was achieved using a thermopneumatic pressing process. Upon completion of the bonding step with each particular specimen, evaluation tests were carried out to determine cladding continuity, bond integrity, and cladding microstructure. (auth)

2186 NACA-TN-4160
NACA-TN-4165
Lewis Flight Propulsion Lab., Cleveland.
THERMAL FATIGUE OF DUCTILE MATERIALS. I. EFFECT OF VARIATIONS IN THE TEMPERATURE CYCLE ON THE THERMAL-FATIGUE LIFE OF S-816 AND INCONEL 550. II. EFFECT OF CYCLIC THERMAL STRESSING ON THE STRESS-RUPTURE LIFE AND DUCTILITY OF S-816 AND INCONEL 550. Francis J. Clauss and James W. Freeman. Sept. 1958. (Pt. I, (NACA-TN-4160). 61p. and Pt. II, (NACA-TN-4165). 43p.)

These two reports were issued separately, but are cataloged as a unit.

Tensile specimens of S-816 and Inconel 550 were alternately heated and cooled while constrained in a manner that prevented their free axial expansion and contraction, and the number of cycles to fracture was determined. Hardness measurements and microstructural studies were also made. The number of cycles to failure was more sensitive to changes in the maximum cycle temperature than to changes in the temperature difference. In further tests, other specimens were treated as described above, except that the thermal cycling was discontinued before failure occurred and the effect measured in relation to the number of cycles. Exposure to thermal-fatigue conditions strengthened S-816 in stress rupture and weakened Inconel 550. (J.R.D.)

2187 NP-6667
Canada. Dept. of Mines and Technical Surveys. Mines Branch.
THE EFFECTS OF FURNACE ATMOSPHERES OF THE SINTERING BEHAVIOUR OF URANIUM DIOXIDE. A. Hubert Webster and Norman F. H. Bright. Feb. 5, 1958. Changed from OFFICIAL USE ONLY Nov. 13, 1958. 56p. (R-2).

The properties of compressed uranium dioxide shapes were examined after sintering in atmospheres of hydrogen, nitrogen + hydrogen, argon, wet argon, argon + oxygen, nitrogen, wet nitrogen, nitrogen + oxygen, and steam over the temperature range 1200 to 1500°C. Attention was given particularly to the control of the non-stoichiometric oxygen in the oxide before, during, and at the completion of the sintering. It was shown that the presence of non-stoichiometric oxygen up to a certain limit is desirable in the oxide to be sintered, and that it is also desirable that this non-stoichiometric oxygen should remain in the oxide while the sintering is taking place if it is desired to achieve good sintering at relatively low temperatures. However, the excess oxygen should be removed to yield an essentially stoichiometric oxide on cooling in order that the product may have satisfactory characteristics when used as a fuel element. The atmospheres listed above were examined with a view to achieving control of the non-stoichiometric oxygen at the various stages, and a recommended procedure to achieve the desired result was outlined. Use was made of the published thermodynamic data for the uranium dioxide/oxygen system in interpreting the results and in forecasting suitable sintering conditions. (auth)

2188 NP-6988
Brussels. Centre D'Étude de l'Énergie Nucléaire.
AFFINAGE ET STABILISATION DU GRAIN D'URA-

NIUM PAR FAIBLES ADDITIONS. (Refining and Stabilization of the Grain of Uranium by Small Additions). J. J. Huet. ETUDE DU REPROCESSING METALLURGIQUE. (Study of Metallurgical Processing). Ph. Van Asbroeck. FABRICATION, EN BELGIQUE, D'ELEMENTS DE COMBUSTIBLE POUR BR-II. (The Fabrication, in Belgium, of Fuel Elements for the BR-II). E. Jonckheere. Aug. 4, 1958. 32p.

With the goal of improving the grain of uranium, binary and ternary alloys containing less than 1 wt. % of zirconium, niobium, silicon, tin, aluminum, chromium, and vanadium were tested with and without forging and before and after thermal treatment. Alloys having a grain less than 50 μ were considered good. Niobium alone (0.03%) or associated with chromium (0.15% Nb and 0.03% Cr) or zirconium (0.15% Nb and 1.0% Zr) refined the grain of uranium to a large extent. For the forged samples, the ternary alloys with 1% Zr and 0.02% V seemed the best with the grain less than 40 μ. The binary and ternary alloys containing 0.66% Cr, 1.0% Zr with 0.03% Cr, 0.15% Nb with 0.03% Cr, and 0.30% Nb all had grains less than 50μ. Zone melting of aluminum and uranium was tested for possible use in the processing of irradiated fuel elements. The results showed that this method could be used for purification of both metals. The fabrication of the "sandwich" plates, the forming of the plates and fabrication of the assembly, and the control of the component parts for the BR-II are described briefly. (J.S.R.)

2189 NP-7035

Case Inst. of Tech., Cleveland.

THE PRESSURE DERIVATIVES OF THE ELASTIC CONSTANTS OF ALUMINUM AND MAGNESIUM TO 6,500 BARS (thesis). Technical Report No. 2. Richard E. Schmunk. Sept. 1958. 39p. Project NR-017-309. Contract NONR-1141(05).

The pressure derivative of the elastic stiffness constants of aluminum and magnesium have been measured over a pressure range from 0 to 6500 bars, using a modified ultrasonic pulse echo method. The values found for the pressure derivative of the elastic stiffnesses of aluminum and magnesium are tabulated. The pressure data for aluminum were interpreted in terms of Leigh's theory for the elastic stiffnesses themselves, and the magnesium data in terms of the theory of Reitz and Smith. Variation of the effective charge density at the boundary of the atomic polyhedron under volume strain causes the electrostatic contribution to the shear stiffnesses to vary approximately as r^{-8} instead of r^{-4}, for both metals. Electron transfer from states overlapping one type of Brillouin zone face to states overlapping another type of face under volume strain contributes appreciably to the variation of the Fermi shear stiffness with pressure. (auth)

2190 NP-7038

Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.

THE EFFECT OF FOREIGN SUBSTANCES ON THE STRENGTH OF POWDER-METAL AGGREGATES. OOR Final Report. Otto Zmeskal. Sept. 30, 1958. 122p. OOR Project 1423. Contract DA-01-009-ORD-439.

The properties of metal–oxide mixtures produced by the methods of powder metallurgy are described. The metal matrices covered are Cu, Ti, Zr, and Fe. The oxides were introduced by mixing the pure oxides with pure metal powders. For each metal a program was devised to determine the optimum conditions of particle size, method of aggregation, pressing pressure, sintering atmosphere and temperature and additional pressing and sintering operations. The criteria used were density and hardness. Both cylinders and tensile bars were evaluated. (W.L.H.)

2191 SCTM-133-56(16)

Sandia Corp., Albuquerque, N. Mex.

A STUDY OF STANDARD CLEARANCE HOLE SIZES, POSITIONAL TOLERANCES AND DRILL SIZE SELECTION FOR STEEL AND CAST IRON. Clyde I. Millard. Jan. 17, 1957. 25p. Contract [AT(29-1)-789]. (M-6106). $4.80(ph OTS); $2.70(mf OTS).

Standard clearance hole sizes for the common screw fastener sizes, positional tolerances, and assembly applications were established. These clearance hole sizes are expressed as standard drill sizes. In arriving at these drill sizes, consideration was given to the fact that drills cut oversize and that derivations in the size of drilled holes must be expected even under ideal operating conditions. (auth)

2192 UK/C/5/117

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

DIFFUSION OF FISSION PRODUCT GASES FROM COMPACTED UO_2. [Paper presented at] Fifth UK/Canada Technical Conference, October 22 to 24, 1956. A. H. Booth and R. F. S. Robertson. Sept. 1956. 12p.

Laboratory determinations of diffusion constants of stable isotopes of krypton and xenon released in the fission of compacted UO_2 specimens were made. Results lead to the conclusion that a large fraction of the gases may be liberated from the fuel during long irradiation; however, it is thought that the results of the laboratory experiments cannot be extrapolated to reactor operating conditions. The experiments are described as a basis for discussion. In addition, defect tests of compacted UO_2 specimens sheathed in Zircaloy-2 were carried out in NRX loops. The results of each irradiation are briefly described. (J.R.D.)

2193 WADC-TR-58-161

Battelle Memorial Inst., Columbus, Ohio.

A STUDY OF BETA EMBRITTLEMENT IN HIGH-STRENGTH TITANIUM ALLOYS. Period covered: March 1, 1957 to February 28, 1958. Andrew J. Griest, Arthur P. Young, Herbert A. Robinson, and Paul D. Frost. Mar. 31, 1958. 92p. Project title: METALLIC MATERIALS. Task title: TITANIUM AND TITANIUM ALLOYS. Contract AF33(616)-5007. (AD-155835).

Studies were conducted to determine the importance of beta grain size as a contributing factor to the loss of ductility that occurs when titanium alloys are heat treated at temperatures above the beta transus. In a second phase of the research a heat-treatment program was carried out in an effort to develop procedures for restoring ductility in beta-embrittled material. To supplement these studies, a microscopic study of deformation in pertinent microstructures was conducted. The primary cause of beta embrittlement is the large grain size which is obtained so rapidly in many alpha-beta titanium alloys when heated into the beta field. Grain-boundary alpha and acicular intragranular alpha in the microstructure are not detrimental if the beta grain size is fine. The structures resulting from beta treatments are quite stable and can not be significantly altered in a beneficial way by heat treatment alone. Certain alloys (such as Ti-16V-2.5Al) show a relatively

low rate of beta grain growth. Development of alloys exhibiting this property appears to offer the most promising means of avoiding or minimizing beta-embrittlement effects. (auth)

2194 WADC-TR-58-365
Southern Research Inst., Birmingham, Ala.
DETERMINATION OF TENSILE, COMPRESSIVE, BEARING, AND SHEAR PROPERTIES OF SHEET STEELS AT ELEVATED TEMPERATURES. [Period covered]: January 1957 to May 1958. J. Robert Kattus, James B. Preston, and Herman L. Lessley. Sept. 1958. 298p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. Contract AF33(616)-3876.

The tensile, compressive, bearing, and shear properties of the following sheet metals were determined at various temperatures after exposure times of from ½ hour to 1000 hours at the test temperature: A-286 austenitic alloy, quenched and tempered; 17-7 PH stainless steel, RH 950 condition; Thermold J alloy steel, quenched and tempered; Type 420 stainless steel, quenched and tempered; Type 422 stainless steel, quenched and tempered; and 17-22 A (S) alloy steel, quenched and tempered. The A-286 alloy was tested over a temperature range from 75 to 1200°F, the Thermold J from 75 to 1100°F, and the other alloys from 75 to 1000°F. In all of the test alloys, the strength properties and moduli of elasticity decreased with increasing temperatures. The strength properties of the Thermold J, Type 420, Type 422, and 17-22 A (S) tended to decrease by varying amounts with increasing exposure times at the higher test temperatures. These decreases in strength are believed to be associated with structural changes produced by tempering. At lower temperatures, the properties of these materials did not vary significantly with exposure time, indicating that the structures were stable at those temperatures. The strength properties of the A-286 alloy and the 17-7 PH (RH 950) stainless varied somewhat erratically with increasing exposure times at the higher test temperatures as a result, probably, of aging phenomena in both of these precipitation-hardening alloys. The simple ratio relationships between various properties under equivalent test conditions were approximately equal in magnitude and in consistency to those previously determined for other materials and reported in WADC Technical Report 56-340. For the entire ranges of materials and conditions used in this work, the consistency of the various property relationships ranged from ± 17% to ± 71%. Precise data on the mechanical properties of aircraft-structural materials can be obtained only by testing under the desired condition. (auth)

2195 WAPD-TM-147
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
LABORATORY METHOD FOR ADJUSTING HYDROGEN CONTENT OF ZIRCONIUM. John J. Kearns. May 26, 1958. 55p. Contract AT-11-1-Gen-14. $9.30(ph OTS); $3.60(mf OTS).

A new method of introducing predetermined quantities of hydrogen into zirconium was developed and evaluated. The procedure is simple, effective, and inherently good in preventing oxygen and nitrogen contamination. Zirconium samples containing four levels of dissolved oxygen, in the range 160 to 1380 parts per million, were hydrogenated to 100, 300, 3500, and 7700 ppm hydrogen. Dissolved oxygen was found to decrease hydrogen absorption in both the alpha and beta modifications of zirconium. The effect of hydrogen on density, hardness, and microstructure was determined. X-ray-diffraction measurements were also obtained. (auth)

2196 AEC-tr-3395
POROUS SINTER METALS, THEIR PRODUCTION AND UTILIZATION. R. Palme. Translated for Oak Ridge Gaseous Diffusion Plant from Metall 12, 28-32(1958). 17p.

2197 AEC-tr-3419
SILVER–INDIUM ALLOYS. A CONTRIBUTION TO THE QUESTION OF OXIDE-RESISTANT SILVER ALLOYS. Ernst Raub and Alice Schall. Translated by S. E. Piel (Westinghouse Electric Corp. Bettis Atomic Power Div.) from Z. Metallkunde 30, 149-51(1958). 10p.

The effect of In on corrosion properties of Ag was studied. Workability of Ag–In and Ag–In–Cu alloys is reported. Experiments in electrolytic precipitation of In and Ag–In were not successful in producing a satisfactory coating. (T.R.H.)

2198 AEC-tr-3464
ON THE ENERGY OF VACANCY FORMATION IN SOLID METALS. K. A. Osipov. Translated by S. Rothman (Argonne National Lab.) from Doklady Akad. Nauk S.S.S.R. 121, 855-7(1958). 5p.

The role that vacancies in solid metals are thought to play in self-diffusion processes are discussed and expressed mathematically. The idea concerning the limiting and changing values of the activation energy in different processes may be expressed as $\Delta H_{fr} = nq$ for materials without polymorphic transformation, and $\Delta H_{gr} = nq_{\alpha,\beta}$ for metals with a polymorphic transformation. In these relations, $n \geq 1$ and depends on the angle of disorientation of the neighboring grains, while quantities q and $q_{\alpha,\beta}$ do not depend on the misfit angle. ΔH is the activation energy for volume self-diffusion and diffusion, q is the activation energy for self-diffusion referred to one atom in a group of n atoms, and gr is the expression for grain-boundary self-diffusion. The $q_{\alpha,\beta}$ values for the α modification of iron, titanium, and zirconium were calculated, and it is pointed out that the calculated values correspond to the vacancy formation energies for iron, titanium, and zirconium. (J.R.D.)

2199 AEC-tr-3479
RARE EARTH METALS. Felix Trombe. Translated for Ames Lab. from Rev. met. 52, 2-33(1956). 114p.

The metallurgy of the rare earths is discussed including alloying effects, separation, and purification. After a discussion of the physical properties of rare earths, special topics are discussed: allotopic transformations of Ce; physical phenomena accompanying the magnetic anomalies of Gd and Dy; influence of pressure on the properties of some rare-earth metals; chemical properties of rare-earth metals; phase diagrams; alloys with the Fe group; alloys with Mg; industrial utilization of rare earths; rare-earth metals in cast irons; rare earths in steel; rare earths in Al; and rare earths in Mg. 186 references. (T.R.H.)

2200 AEC-tr-3482
ELECTRICAL CONDUCTIVITY AND PHASE DIAGRAM OF BINARY ALLOYS. XVII. THE LITHIUM–ALUMINUM SYSTEM. G. Grube, L. Mohr, and W. Breuning. Translated by K. S. Bevis (Savannah River Lab.) from Z. Elektrochem. 41, 880-3(1935). 7p.

Lithium–aluminum alloys were investigated by the thermal analytical method and by plotting temperature-resistance curves. The phase diagram was drawn from the results of the measurements. The investigation

revealed that the liquid metals are not soluble in each other in all proportions and that the limit of concentrations of the α-solid solution occurring on the aluminum side is found between 600°C and room temperature. The Li_2Al type of crystal is formed at 521°C by peritectic reaction between the β-solid solution and the melt, and the LiAl type of crystal forms the solid solution with excess lithium, the homogeneity range of which extends from 50 to 56 at. % Li at 521°C. (J.R.D.)

2201 NP-tr-181

INFLUENCE OF CHROMIUM, MOLYBDENUM AND TUNGSTEN ON THE SELF-DIFFUSION OF IRON IN DILUTE α-SOLID SOLUTIONS. I. B. Borovskii, K. P. Gurov, and Yu. G. Miller. Translated by J. Adam (U.K.A.E.A., Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 118, 280-3(1958). 5p. (Figures omitted).

A model explaining the particular character of the electronic spectrum and the presence of supplementary local bonding forces in dilute solid solutions based on transition metals with unfilled (n-1)d and (n-1)f electron shells was developed. The model is based on studies of the electron energy spectrum of dilute solid solutions including the effect of Cr, Mo, and W on self diffusion in iron. The methods are described, and the results are examined and presented graphically. (J.R.D.)

2202

THE DISSOCIATION OF CERTAIN Cu–Ni–Fe ALLOYS (STUDY WITH THE AID OF X RAYS). D. Bally and C. Maris (Institut de Physique Atomique, Bucharest). Acad. rep. populaire Roumaine rev. phys. 3, 33-44(1958). (In French)

The theoretical and experimental study of the structure of Cu–Ni–Fe alloys is reported. The study of the diffraction patterns of the alloy after isothermal treatment at 550°C suggests the hypothesis of a mechanism of deformation of the crystalline lattice identical to that proposed by Hargreaves (Acta Cryst. 4, 301(1951)). The introduction of the hypothesis of asymmetry of the deformation centers leads to a simple relation between the dimension of the deformation center and the ratio of the intensities of the satellites and fundamental fringes. The agreement of the results obtained by the use of this relation and those obtained by an evaluation of the deformation factor which modifies the relative intensities of the diffraction maxima constitutes a verification of the relations used for the calculation. (J.S.R.)

2203

PRODUCTION OF ELECTROLYTIC THALLIUM PRECIPITATES FOR THE PREPARATION OF SEALED RADIOACTIVE PREPARATIONS. G. Vormum and D. Sarrach (Deutschen Akademie der Wissenschaften, Berlin-Buch). Atompraxis 4, 332(1958). (In German)

A method is given for the preparation of thallium films with a smooth surface and surface coatings of 5 mg/cm^2. The thallium was electrolytically precipitated from solution. (J.S.R.)

2204

SENSITIVITY OF A METHOD EMPLOYING GAMMA RAYS FROM RADIOACTIVE COBALT FOR X-RAYING OF PRODUCTS MADE OF THIN STEEL. M. P. Zheldak and P. M. Yushkevich. Byull. Nauchno-Tekh. inform. Vses. n.-i. trubnyy in-t No. 3, 101-7(1957). (Translated from Referat. Zhur., Met. No. 3, 1958).

Investigations were made to establish how the shape and size of artificially induced defects affect their detection with gamma rays. The effect of the defects on the sensitivity to focal length was also determined in steel of various thickness. Special flaw-containing wire specimens were manufactured with cylindrical openings and grooves. Experimental data confirmed the assumption that the detection of defects is influenced by both their geometric size and their actual size. It was concluded that the tests on the sensitivity of gamma radiography, as reported in the literature, gave results higher than the actual values. (J.S.R.)

2205

PROTECTIVE COATINGS LIMIT CORROSION. Robert V. Jelinek (Syracuse Univ., N. Y.). Chem. Eng. 65, No. 21, 163-8(1958) Oct. 20.

The basic principles and practices in the use of protective coatings are considered, including surface preparation, application of metallic coatings, inorganic surface conversion treatments, applications of vitreous enamels, and the use of organic coatings. Factors in materials selection are discussed, and several sources of corrosion information are listed. (J.R.D.)

2206

OBSERVATION AND SIMULTANEOUS HEATING OF THIN METALLIC SAMPLES AT THE INTERIOR OF AN ELECTRON MICROSCOPE. Aurel Berghezan and Angéline Fourdeux. Compt. rend. 247, 1194-6(1958) Oct. 20. (In French)

A method is described for the simultaneous heating and observation with an electron microscope of thin metal foils. Some examples of the possibilities of this method are given. The restoration of deformed aluminum, precipitation in an Al–Cu alloy, and diffusion in an Al–Cu alloy were studied, and the results are discussed. (J.S.R.)

2207

ZONES OF ABNORMAL DISTRIBUTION, AT LOW TEMPERATURES, OF THE MECHANICAL PROPERTIES UNDER STRESS OF VERY SOFT STEEL. John Barry Lean and Jean Plateau. Compt. rend. 247, 1196-9(1958) Oct. 20. (In French)

Evidence is given in stress studies of polished and notched soft steel of temperature zones in the vicinity of the ductility transition, in which the mechanical properties have an abnormal distribution. The study of brittle rupture in these zones showed that, even for the most brittle rupture mechanisms, the rupture is preceded by the formation of Piobert-Lüders bands. (tr-auth)

2208

PURE METALS. José Terranza Martorell and Jacobo Díaz Diaz. Energia nuclear (Madrid) 1, No. 4, 27-38 (1957) Oct.-Dec. (In Spanish)

The effect of trace impurities on the electric conductivity, ductility, corrosion resistance, thermal conductivity, and neutron absorption has made the production of pure metals of increasing importance. The criteria of purity are discussed. Methods of purification and refining are described with special emphasis on the van Arkel method and zone melting. Purity control in metal production is discussed. (J.S.R.)

2209

THE CHEMICAL PROBLEM OF THE CONTROL OF NUCLEAR PURITY. Ricardo Fernández Cellini. Energia nuclear (Madrid) 1, No. 4, 39-45(1957) Oct.-Dec. (In Spanish)

The necessity for high purity in reactor materials, especially uranium, is discussed. Chemical methods

and instruments used to control purity in uranium production and processing are described. (J.S.R.)

2210

HIGH PERFORMANCE MATERIALS, ALLOYS AND REACTIVE METALS. F. S. Badger (Haynes Stellite Co., Kokomo, Ind.). Ind. Eng. Chem. 50, 1608-11(1958) Nov.

Corrosion tests were made of molybdenum, stainless steels, Hastelloy alloys, tantalum, zirconium, tungsten, and niobium under various conditions in widely used mineral acids, such as nitric, hydrochloric, phosphoric, and sulfuric. The results are tabulated and graphically represented. In addition, some comparisons of oxidation rates of metals and alloys are presented. The presentation is intended as a guide for selecting alloys and metals for service under corrosive conditions in the chemical industry. (J.R.D.)

2211

ON THE RADIOINDUCED CHANGES IN MARTENSITE TRANSFORMATION KINETICS. A. I. Zakharov and O. P. Maksimova. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 7, 3-9(1958) Aug. (In Russian)

Effects of preliminary neutron irradiation on the kinetics of isothermal martensite transformations at various temperatures were investigated, and studies were made of the measures for eliminating the irradiation aftereffects in slowly increased annealing. (R.V.J.)

2212

CHANGES IN STRUCTURAL CONVERSION IN IRON–NICKEL ALLOYED WITH MOLYBDENUM. Yu. S. Avraamov, B. G. Livshits, and V. B. Osvenskii (Stalin Moscow Inst. of Steel). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 1263-8(1958) Oct. (In Russian)

The electric resistance, hardness, temperature dependence of internal friction, and magnetization saturation were measured in order to determine the nature of structural transformations in Fe–Mo–Ni alloys and to find the critical temperature interval for these alloys. (R.V.J.)

2213

A HISTORY OF THE EARLY BRITISH WORK ON PLUTONIUM METALLURGY. J. G. Ball (Imperial Coll. of Science and Tech., London) and W. B. H. Lord (A.W.R.E., Aldermaston, Eng.). J. Brit. Nuclear Energy Conf. 3, 225-36(1958) Oct.

The work on plutonium metallurgy from its beginning to the end of 1953 is described. The experiments included the use of dilatometry and thermal analysis to investigate the allotropy and alloying behavior of the metal, with other work on casting, forging and extrusion, electrical resistivity, magnetic susceptibility, and the determination of crystal structures. (J.E.D.)

2214

A STUDY OF CORROSION FILMS IN ZIRCONIUM AND ITS ALLOYS BY IMPEDANCE MEASUREMENTS. J. N. Wanklyn and D. R. Silvester (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Electrochem. Soc. 105, 647-54(1958) Nov.

The oxide films formed on zirconium and some of its alloys during corrosion in steam and water at 325°C have been studied by impedance measurements made by immersion in an electrolyte. A fall in the protective character of the film is accompanied by an increase of capacity, and measurements of the latter provide a useful method of comparing films. The behavior of the resistive part of the impedance and the influence of frequency and electrolyte conductivity are complex, and only a partial interpretation can be given. (auth)

2215

ANODIC OXIDE FILM FORMATION OF ZIRCONIUM KINETICS WITH AND WITHOUT CONCURRENT OXYGEN EVOLUTION. George B. Adams, Jr., Tien-Shuey Lee, Samuel M. Draganov, and Pierre Van Rysselberghe (Univ. of Oregon, Eugene). J. Electrochem. Soc. 105, 660-5(1958) Nov.

Comparative studies were made with zirconium to determine whether differential formation fields measured below oxygen evolution potentials agreed with those measured at high voltages. It was found that the low-voltage field is some fifteen to thirty per cent higher than the corresponding field obtained at high voltages. However, the field lowering of the activation energy for the anodic oxidation is the same whether derived from high or low-voltage measurements. This is also true of the activation energy. These results confirm the view that the metal is anodically oxidized to the corresponding oxide at unit current efficiency below the reversible oxygen evolution potential. Ionic current efficiencies are reported for zirconium at several current densities in the high-voltage range and for the low-voltage localized oxygen evolution process. (auth)

2216

BERYLLIUM, ITS PROBLEMS AND POSSIBILITIES. Joseph R. Lane. J. Metals 10, 738-42(1958) Nov.

The applications of beryllium in airframes and in other structures are discussed. In addition, a survey of probable future uses of the metal are investigated. (J.R.D.)

2217

HIGH TEMPERATURE METALLURGY TODAY. L. P. Jahnke and R. G. Frank (General Electric Co., Cincinnati). Metal Progr. 74, No. 5, 77-82(1958) Nov.

A survey of the most promising areas for high-temperature development is presented. In addition, a listing of the best alloys among the light metals and steels is given. (J.R.D.)

2218

TWO NEW 1800°F ALLOYS FOR CAST TURBINE BLADES. J. T. Brown and J. E. Wilson (General Electric Co., Cincinnati). Metal Progr. 74, No. 5, 83-7(1958) Nov.

The properties and applications of Nicrotung and DCM alloys are described. Nicrotung is a nickel-base alloy with a nominal composition of 12% Cr, 10% Co, 8% W, 4% Al, 0.10% Ti, 0.05% C, 0.05% Zr, and the balance nickel. DCM alloy has a nominal composition of C 0.08% maximum, Mn 0.10% maximum, Si 0.15%, S 0.015% maximum, Cr 14 to 16%, Ti 3.35 to 3.65%, B 0.070 to 0.090%, Al 4.4 to 4.8%, Mo 4.5 to 6%, Fe 4.0 to 6.0%, Cu 0.10% maximum, and Ni balance. (J.R.D.)

2219

BABBITTING BEARINGS BY CENTRIFUGAL FORCE. W. B. Keyser (Goodyear Atomic Corp., Portsmouth, Ohio). Metal Progr. 74, No. 5, 90-1(1958) Nov.

The low-strength handicap of babbit is overcome by bonding a thin layer to a strong backing material. An improved centrifugal casting method resulting in a more uniform structure in the bearing metal is described. (J.R.D.)

2220

EDGE-WELDING SMALL CONTAINERS. D. W. Grobecker (Sandia Corp., Albuquerque, N. Mex.). Metal Progr. 74, No. 5, 104-7(1958) Nov.

Gas-tight seals can be readily made in small containers to protect pressure-sensitive or temperature-

sensitive electrical and electronic assemblies. Tungsten arc, protected by argon gas, makes edge welds between walls and bases in simple semi-automatic devices. (auth)

2221

PRESSURE VESSELS AND THE PROBLEM OF BRITTLE FRACTURE. H. Harris. Metallurgia 58, 213-17(1958) Nov.

The present status of work on the problem of brittle fracture of steel at low stresses is discussed. Recent investigations have shown that when a crack is initiated in a sample of steel held under a constant tensile stress, but with a temperature gradient so chosen that the crack is initiated at a low temperature, the crack is arrested at some higher temperature, called the crack arrest temperature. The test results show that there is a transition temperature, of the order of 0°C, above which the crack, once initiated, will continue to travel even though the applied stress is only of the order of 4 tons/sq. in. In other experiments, welding test plates 1 in. in thickness and 3 ft. in width were made with artificial defects in the weld. The plates were cooled to a pre-selected temperature and then stressed uniformly in the direction of the weld. It was found that a relationship existed between the temperature and the stress necessary to initiate failure. The Research Laboratories of Colvilles, Ltd., undertook an investigation to determine the influence of residual stresses. As a result of this series of tests it was shown that the presence of the residual stresses consequent on the welding operation were necessary if fracture at stresses lower than the yield point were to be initiated. (J.H.M.)

2222

THE DEVELOPMENT OF BERYLLIUM FOR NUCLEAR REACTOR APPLICATIONS. G. C. Ellis (Atomic Weapons Research Establishment, Aldermaston, Eng.). Metallurgia 58, 243-50(1958).

The production, fabrication, and mechanical properties of beryllium ingots and powder are discussed. The main difficulty in ingot production is the elimination of unsoundness. Excessive solidification rates causes the formation of radial intercolumnar secondary pipe. However, these difficulties can be avoided, with reasonable consistency, by the use of intermediate solidification rates. The main unsoundness defect exhibited by ingot beryllium is a hair line crack extending axially from the pipe cavity. Attempts have failed in eliminating this defect in ingots of 8 in. diameter, or greater. In comparison with ingot beryllium, vacuum hot pressed or pressureless sintered powder offers distinct advantages for reactor use. It permits the consistent production of sounds parts, with little restriction on maximum size. The powder products exhibit a fine grained structure of random orientation, which leads to good machinability and surface finish, together with relatively good fabrication characteristics and fabricated properties. (For preceding article in series, see Metallurgia 58, 173-6(1958).) (auth)

2223

GRAPHITE: ITS PROPERTIES AND BEHAVIOUR. W. G. O'Driscoll (United Kingdom Atomic Energy Authority, Culcheth Labs., Lancs, Eng.) and J. C. Bell (United Kingdom Atomic Energy Authority, Windscale Works, Sellafield, Cumb., Eng.). Nuclear Eng. 3, 479-85(1958) Nov.

The physical, mechanical, and nuclear properties and the manufacture of nuclear grade graphite are discussed. Physical properties studied include density, thermal and electrical conductivity, and expansion. Mechanical properties of elasticity, creep, and fatigue are discussed. The compatibility of graphite with liquid metals and gases is reviewed. (W.D.M.)

2224

PRECISION TUBES FOR NUCLEAR APPLICATIONS. D. F. Waterhouse. Nuclear Eng. 3, 486-90(1958) Nov.

The manufacture of precision tubes of titanium, zirconium, tantalum, niobium, vanadium, molybdenum, and beryllium in a wide variety of shapes and sizes is discussed. (W.D.M.)

2225

DISSOLVING STAINLESS STEEL. DEVELOPMENTS IN HEAD END PROCESSES FOR HANDLING S.S.–UO_2 DISPERSIONS. F. S. Martin and M. J. Waterman (United Kingdom Atomic Energy Authority). Nuclear Eng. 3, 496(1958) Nov.

A summary is presented of a recent report (A.E.R.E. C/R 2454) describing investigations of methods which would enable stainless-steel based fuels to be dissolved directly in nitric acid. Two lines of investigation were followed: one in which the steel is initially treated at a high temperature with ammonia or methane, and two in which the steel is used as a soluble anode in a nitric acid electrolytic bath. The use of either of these methods would have advantages in that no special dissolver vessel material would be needed, and no special feed pre-conditioning, such as chloride ion removal, would be required at the solution stage. (W.D.M.)

2226

ENVIRONMENTAL MONITORING FOR BERYLLIUM. R. O. R. Brooks (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 3, 549-52(1958) Nov.

Evaluation of the concentration of beryllium and beryllium compounds in air and on surfaces in the vicinity of laboratory personnel is discussed. Practical experience gained at Harwell over a period of several years is outlined. (W.D.M.)

2227

METALLOGRAPHIC STUDIES OF METALS AFTER EXPLOSIVE SHOCK. Cyril Stanley Smith (Univ. of Chicago). Trans. Met. Soc. AIME 212, 574-89(1958) Oct.

Samples have been subject to plane shock waves of intensities up to 600 kbars and recovered substantially undamaged. Deformation in a shock front has a unidirectional character that distinguishes it from other modes of deformation and is in essence a transformation from normal to high-density material produced by the translation of a well-defined two-dimensional interface. Both copper and iron are hardened by ca.400-kbar shock more than by cold-rolling to 95% reduction, although the dimensions of the sample are virtually unchanged. Copper after shocks of above about 200 kbars shows numerous mechanical twins, which, however, make no significant contribution to the hardening. They occur most frequently at angles of 30 deg to the rarefaction direction and do not appear in the zone where rarefaction is steepest. Iron, conversely, develops Neumann bands on compression and above 130 kbars undergoes a transition to a different phase, which after return to atmospheric pressure, leaves a complex microstructure reminiscent of carbon-free martensite. If the first of the two shocks associated with the transition

in iron is reflected as rarefaction by a free surface, it can be made to interact with the second shock and, by abruptly decreasing the pressure, will preserve details of the shock front that have hitherto been inaccessible. The shock front is no thicker than 0.02 mm and the transformation occurs in times of the order of 10^{-9} sec. Measurements of the position of the interaction zone give directly the ratio of the velocities of the two shocks. Metallography promises to be a useful tool in studies of shock hydrodynamics. (auth)

2228

LAYER GROWTH DURING INTERDIFFUSION IN THE ALUMINUM–NICKEL ALLOY SYSTEM. L. S. Castleman and L. L. Seigle (Sylvania Electric Products Inc., Bayside, N. Y.). Trans. Met. Soc. AIME 212, 589-96 (1958) Oct.

The kinetics of growth of intermediate phase layers in the aluminum–nickel system has been explored in diffusion couples annealed in the temperature range 400 to 625°C for times up to 340 hr and under pressures up to 5 tsi. It has been found that all phases appear in the interdiffusion zone at 600°C that are thermodynamically stable at the diffusion temperature; these phases are the $NiAl_3$ (β), Ni_2Al_3 (γ), NiAl (δ), and Ni_3Al (ϵ) intermetallic compounds. The rate controlling factor affecting the kinetics of growth of the γ phase in the early stages is not yet clear; after a minimum thickness of 0.025 to 0.030 mm is reached, however, volume diffusion controls layer growth. It is estimated that the chemical diffusion coefficient is 9.1×10^{-10} sq cm per sec and that the heat of activation for diffusion is 31,000 cal per mol. An applied pressure of 5 tsi reduces the diffusion rate by about 27 pct. Volume diffusion controls the growth kinetics of the β phase after a minimum thickness of 0.040 mm is reached; it is estimated that the 600°C diffusion coefficient is about 1.8×10^{-11} sq cm per sec and that the heat of activation is approximately 27,000 cal per mol. Tentatively, it appears that pressure affects the growth of the β phase much less than the γ phase. The growth kinetics of the δ and ϵ phases also appear to be volume diffusion controlled. (auth)

2229

SELF-DIFFUSION OF SILVER IN MOLTEN SILVER. Ling Yang, Satoshi Kado, and G. Derge (Carnegie Inst. of Tech., Pittsburgh). Trans. Met. Soc. AIME 212, 628-30(1958) Oct.

Self-diffusion coefficients of silver in molten silver have been measured by means of the capillary-reservoir method in the temperature range 1002° to 1105°C. The results can be represented by the equation $D = (7.10 \pm 0.06) \times 10^{-4} \exp[(-8150 \pm 1130)/RT]$. The heat of activation agrees within the limit of experimental uncertainty with that for the viscous flow. The validity of the Eyring and the Stokes-Einstein equations are examined on the basis of the self-diffusion coefficients obtained and the known viscosity data of molten silver. (auth)

2230

EFFECT OF COMPLEXING ON MECHANICAL PROPERTIES OF Ti–6Al–3Mo ALLOY. F. A. Crossley (Illinois Inst. of Tech., Chicago) and W. F. Carew (Joliet Metallurgical Labs., Inc., Ill.). Trans. Met. Soc. AIME 212, 630-5(1958) Oct.

Tensile, creep-rupture, and stability tests were employed to evaluate the effect of α-strengthening and β-complexing additions on the base composition Ti–6Al–3Mo. The ultimate objective was to produce an alloy of greater strength than the Ti–7Al–3Mo alloy. Strengthening of α was accomplished by additions of 2 and 4% Ge, 4% Sn, 4% Zr, and 2% Sn–2% Zr. Making the β more complex while keeping the total of β-stabilizing additions constant at 3% resulted in higher tensile strengths but lower creep and rupture strengths, especially at 1000°F. None of the more complex versions of the base alloy offers greater promise than the Ti–7Al–3Mo alloy. However, some improvement in the strength of the latter may follow from additions of zirconium perhaps up to 4%. (auth)

2231

THE REDISTRIBUTION OF A SECOND PHASE DURING ANNEALING IN A TEMPERATURE GRADIENT. P. G. Shewmon (Westinghouse Research Lab., Pittsburgh). Trans. Met. Soc. AIME 212, 642-7(1958) Oct.

If a 2-phase alloy is annealed in a temperature gradient, there is a tendency for the piece to be enriched in 1 phase at the hot or cold end of the piece: e.g., Fe_3C concentrates at the hot end of α-Fe and hydrides enrich at the cold end of α-Zr. The physical forces giving rise to this effect are discussed and, for the case where diffusion occurs predominantly in one phase, equations are given for estimating the kinetics of the redistribution. It is concluded that for interstitial solutes, the effect is easily observable under laboratory conditions and should be found in various high-temperature applications where temperature gradients exist. However, for substitutional solutes, the redistribution of the second phase will occur in a reasonable time only under conditions of very high temperature and temperature gradient. (auth)

2232

OXIDATION RESISTANCE OF A Cb–Zr–Ti ALLOY. G. M. Gordon, J. W. Spretnak, and Rudolph Speiser (Ohio State Univ., Columbus). Trans. Met. Soc. AIME 212, 659-60(1958) Oct.

The oxidation rate in the Nb–Zr binary system was found to decrease rapidly with increasing Zr content up to 35 at.% Zr. Also, Zr contents higher than 35 at.% gave still better resistance to oxidation. Alloys containing 45 to 60 at.% Zr exhibited the best oxidation behavior at 1000°C, and their oxide films did not spall upon cooling. The addition of 5 to 10 at.% Ti to alloys in this range further improved the oxidation rate and the nature of the oxide film formed. The alloy exhibiting the best behavior of those tested (44.5 at.% Nb, 50.1 at.% Zr, 5.4 at.% Ti) had a very hard and coherent oxide film which was 5 mils thick after 100 hr at temperature. Ternary additions other than Ti to Nb–Zr alloys may still further enhance the oxidation properties. (J.E.D.)

2233

RELATIONS OF HIGH-TEMPERATURE PROPERTIES OF A Ti + Al HARDENED NICKEL-BASE ALLOY TO CONTAMINATION BY CRUCIBLES. R. F. Decker (International Nickel Co., Inc.), and John P. Rowe and J. W. Freeman (Univ. of Michigan, Ann Arbor). Trans. Met. Soc. AIME 212, 686-94(1958) Oct.

During the course of a study of the influence of melting practice on the hot-working characteristics and creep-rupture properties of a Ti + Al hardened nickel-base alloy, it was found that during vacuum induction melting the major variable was the type of ceramic used for the crucible. Analytical studies of the materials by industrial concerns indicated that trace amounts of zirconium or boron were derived from the crucibles. This reduced cracking during hot working and increased rup-

ture strength and ductility. Heats made in alumina crucibles had poor characteristics. Zirconium derived from zirconia crucibles improved characteristics. Boron derived during melting from the usual contamination of magnesia with borate compounds was more beneficial than zirconium. Equivalent additions of zirconium or boron to heats made in alumina produced properties comparable to those heats made in zirconia or magnesia. (auth)

2234

ZIRCONIUM AND HAFNIUM PHASES ISOSTRUCTURAL WITH Ti_2Ni. M. V. Nevitt and L. H. Schwartz (Argonne National Lab., Lemont, Ill.). Trans. Met. Soc. AIME 212, 700-3(1958) Oct.

The existence of seven Ti_2Ni-type phases containing zirconium or hafnium is reported, and lattice parameters are given. For some of these phases there is evidence that oxygen is required for stability. (auth)

2235

THE EFFECT OF THE pH ON THE CORROSION RESISTANCE OF METALS. A. Ya. Shatalov. Trudy Voronezh. Univ. 40, 73-86(1956). (Translated from Referat. Zhur., Met. No. 12, 1957.)

A study has been made of the effect of the pH on the corrosion resistance of Cu, Mg, Zn, Cd, Al, Sn, Pb, Bi, Mo, W, Mn, and Fe in buffer solutions with varying Cl^- content (from 0.0 to 1.0 N) and in simple non-buffer solutions with fixed anion concentrations. Five types of curves showing the dependence of corrosion (K) on pH are obtained, the breakdown of the tested metals by curve type being as follows: (1) Mo, W; (2) Ag, Pt, Ta, Ti; (3) Cd; (4) Cu, Zn, Al, Sn, Pb, Bi; (5) Mg, Mn, Fe. Metals of the first type are completely corrosion-resistant for the full range of the pH scale, down to the strongest alkaline solutions, where the K curve rises. Metals of the second type are absolutely corrosion-resistant throughout the entire pH range. The rate of solution of Cd diminishes very quickly during transition into the neutral portion, and declines still more in the alkaline media. With metals of the fourth type there is a characteristic rise in the K curve on both sides of the neutral solutions, in which maximum corrosion resistance is attained. With metals of the 5th group the dissolution rate declines abruptly as the pH increases in acid solutions; in the neutral portion of the pH range there is a band in which the K rate is constant, but in alkaline solutions further passivation occurs and K practically goes to zero. In the case of Cu, maximum resistance to corrosion in the absence of Cl^- occurs at pH 9.5. Introduction of Cl^- into the buffer solution causes the maximum-resistance points to shift toward higher pH values. The corresponding points for Al occur at pH 7, but in solutions of 1 N with respect to Cl^- they occur at pH 8-8.5. Solution of Mg and Mn in acid solutions follows the law: $K = \text{const } [H^+]^a$, the value of a being approximately 2 for both elements. For alkaline solutions of Al the relationship $K = \text{const } [OH^-]^a$ is obtained, in which a = 1.3. The dependence of the anodic control on the pH value is calculated for the series of metals. From a comparison of the corrosion-resistance values and stationary-potential curves eight separate schematic diagrams of the corrosion process are obtained. (TCO)

2236

INERT GASES FOR CONTROLLED-ATMOSPHERE PROCESSES. E. F. Gorman (Linde Co., Newark, N. J.). Welding J. (N. Y.) 37, 882-9(1958) Sept.

Argon and helium are available at high levels of purity and present no problem for controlled-atmosphere processes. Helium is presently in short supply; however, argon is available in any desired quantity. Difficulties with contaminator pickups are discussed, and methods of efficient use of argon and helium for controlled-atmosphere processes are described. (J.R.D.)

2237

SUBMERGED-ARC WELDING OF URANIUM. Gale S. Hanks, J. M. Taub, and E. L. Brundige (Los Alamos Scientific Lab., N. Mex.). Welding J. (N. Y.) 37, 890-6 (1958) Sept.

It is not practical to weld uranium without a protective atmosphere because of the metal's tendency to oxidize rapidly, and because of its pyrophoric nature. The submerged-arc process is one in which the flux forms a fluid protective blanket above the liquid filler metal. The flux is composed of 75 wt. % fluorospar and 25 wt. % cryolite. (J.R.D.)

2238

MULTIAXIAL CREEP STUDIES ON INCONEL AT 1500 F. C. R. Kennedy, W. O. Harms, and D. A. Douglas (Oak Ridge National Lab., Tenn.). Paper No. 58-A-193. New York, American Society of Mechanical Engineers, 1958.

The effect of multiaxial stresses on the creep rate and rupture life of Inconel has been investigated. A large range of principal-stress ratios in tension-tension and tension-compression states was studied using axially loaded pressurized tubes. The creep-rate results were compared with both the von Mises (distortion energy) and the Tresca (maximum-shear-stress) criteria. Correlation of the creep-rate results was slightly better using the von Mises criterion; however, the simpler and more conservative Tresca criterion appears to be quite adequate for design considerations. The results of the rupture tests appear to support the maximum principal-stress criterion for time-dependent fracture under multiaxial stress conditions. It was shown, however, that in applying this criterion it is important to compensate for the reduction in rupture life caused by changes in the stress state associated with deformation. Rupture strains were found to be directly related to the deviatoric stresses for constant maximum principal stress. The shear strain at rupture was found to be constant for the same maximum principal stress in tension-tension stress states, thus showing that under these conditions the total ductility of the metal was not impaired by increasing the hydrostatic stress. In tension-compression states, the material sustains greater shear strain before rupture. (auth)

2239

PROBLEMS IN METAL PHYSICS AND METALLOGRAPHY. Symposium of Scientific Reports of the Institute of Metal Physics No. 8. Kiev, Izdatel'stvo Akademii Nauk Ukrainskoi SSR, 1957. 239p. (In Russian)

Problems of metal physics and metallography are discussed, and a series of articles is presented on iron and steel structure, effects of heat treatment on the properties of iron, and austenitic steel and alloys. The crystalline structure and phases of alloyed iron, nickel–aluminum, NaCl and KCl salts, and tin–zinc melts were studied. (R.V.J.)

2240

SYMPOSIUM DE METALLURGIE SPECIALE ORGANISE A SACLAY LES 27 ET 28 JUIN 1957 PAR LE DEPARTMENT DE METALLURGIE ET DE CHIMIE APPLIQUEE.

(Symposium on Special Metallurgy held at Saclay June 27-28, 1957 by the Department of Metallurgy and Applied Chemistry). Paris, Presses Universitaires de France, 1958. 130p. (In French)

A compilation of the papers given at the Symposium on Special Metallurgy held at Saclay from June 27 to June 28, 1957, is presented. (J.S.R.)

2241

RELATION BETWEEN ALLOTROPIC TRANSFORMATION AND SUB-STRUCTURES IN URANIUM. P. Lacombe (Centre de Recherches Métallurgiques de l'Ecole des Mines, Paris). pp. 11-20 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

The different origins of the structure imperfections in uranium are investigated, and an attempt is made to define the possible effect of pre-treatments, either in the β or γ phase, on the final polygonized structure of α uranium. The possible role of the second $\beta \rightleftharpoons \gamma$ allotropic transformation of uranium at 774°C on the birth of polygonized structures is especially considered. The possible effect of substructures on the distribution of impurities or additions to uranium is studied by a comparison of uranium of nuclear purity with a chromium–uranium alloy with a low chromium content. (J.S.R.)

2242

RELATIONS BETWEEN DEFORMATION STRUCTURE AND RECRYSTALLIZATION STRUCTURE. T. J. Tiedema. pp. 21-32 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

An attempt is made to define the effect of factors such as metal purity, nature of cold deformation, and size of metal grains on the recrystallization structure by examination of the face-centered cubic structure. The mechanism of oriented germination for the formation of recrystallization structures is discussed. It is shown how this mechanism and others which have been proposed are inadequate for a description of the formation of this structure. The model proposed by Rowland (J. Inst. Metals 83, 1620(1954)) is described in detail, and it is shown how it is responsible for the formation of germs of cubic orientation. Studies made with monocrystals of copper are described. (J.S.R.)

2243

RELATION BETWEEN POLYGONIZATION AND RECRYSTALLIZATION AND SOME PROBLEMS POSED BY THE THEORIES OF RECRYSTALLIZATION. R. W. Cahn (Univ. of Birmingham, Eng.). pp. 33-40 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

The experimental methods used for the study of the motive force of recrystallization and of the relation between restoration and recrystallization are given, and the results obtained are discussed. The classical methods are the study of the kinetics of recrystallization and the measurement of the energy stored in a cold-worked metal and the release of the energy. The new techniques of studying recrystallization under an applied stress is described, and some results obtained with it are compared with previous data. (J.S.R.)

2244

SEVERAL MICROGRAPHIC ASPECTS OF URANIUM IN THE ALPHA PHASE BEFORE IRRADIATION. J. Lehmann and H. Aubert. pp. 41-6 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

It is shown that it is possible to obtain in pure and weakly alloyed uranium structures from large macle grains to fine martensites. For some of these alloys, Al–U and Cr–U, the transformation is produced by a germination mechanism and well-characterized growth. In Mo–U and Nb–U–Zr alloys, a clear martensite structure was observed. (J.S.R.)

2245

COMPARATIVE STUDY OF THE ALLOTROPIC TRANSFORMATIONS IN IRON AND URANIUM. P. Lehr and J. P. Langeron. pp. 47-56 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

The $\alpha \rightleftharpoons \beta$ phase change of uranium presents a certain number of analogies with the $\alpha \rightleftharpoons \gamma$ transformation of iron. For uranium as for iron, these transformations appear to be effected by processes of germination and growth. There seems to be no crystallographic relation of orientation between the α and β phase in uranium. The allotropic transformations of both metals are accompanied by a relative volume variation of the order of 1%. It results in the creation of internal stresses which are relatively important during the formation of germs and their development. It was shown that these stresses entail a true plastic deformation of the metal during the transformation. (tr-auth)

2246

VARIATION OF THE MECHANICAL PROPERTIES OF MAGNESIUM AND MAGNESIUM ALLOYS AS A FUNCTION OF THE GRAIN. M. B. Boudouresques. pp. 57-72 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

In a reactor the mechanical properties of the fuel cladding can vary because of the effect of vibrations, temperature, and the coolant gas on the grain and the grain joints. A comparative study on 99.8% pure Mg, Mg–0.56% Zr alloy, and Mg–0.85% Zn–0.59% Zr alloy was made to determine the effect of vibrations on the mechanical behavior of a sheath held at constant temperature and the effect of the length and temperature of the annealing on the mechanical resistance of samples tested at room temperature. The results are tabulated. (J.S.R.)

2247

ORIGIN OF THE ANNEALING STRUCTURE. A. Merlini and A Guinier. pp. 73-4 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

A summary is presented of the work done with aluminum monocrystals to determine if the germs of recrystallization can be detected by x-ray diffraction. The investigations were made to test the two theories of recrystallization structure: the theory based on the orientation of the recrystallization germs and that based on the preferential growth of certain germs in the deformed matrix. The results showed in the cold-worked state, outside of the immediate neighborhood of the maximum of the pole figure, that the density of the poles is very weak. By a statistic of the orientation of very large grains obtained by recrystallization, it was confirmed that the pole figure is constituted by very narrow spots and is very clearly distinct from the poles of the cold-worked metal. No evident relation, other than the principal orientations of the deformation structure, was found between the preferential orientations of the annealing structure and the orientations of the secondary maxima of the poles in the cold-worked material. (J.S.R.)

2248
MEASUREMENT OF THE FRAGMENTATION AND DEFORMATION OF PARTICLES OF A COLD-WORKED METAL AFTER ELONGATION BY X RADIATION. (APPLICATION TO ZIRCONIUM). J. H. Mogard (A. B. Atomenergi, Stockholm). pp. 75-8 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

A brief description is given of a radiocrystallographic method in which the form of the profile of the Debye-Sherrer rays are interpreted for a description of the distortion caused by cold-working a metal. The experimental results obtained with zirconium are given and compared with some data on tungsten. (J.S.R.)

2249
HEATING OF ZIRCONIUM FOR ITS TRANSFORMATION WITH HEAT AND WITH COLD. RECRYSTALLIZATION AND RESTORATION OF THE COLD-WORKED METAL. D. Whitwham, J. Boghen, and J. Hérenguel. pp. 79-88 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

The technology of the transformation of zirconium offers many difficulties. Tests with zirconium and Zircaloy-2 were made to determine a technique of working with zirconium and its alloys in heat or cold. The work, divided into two parts, consisted of following the metal structure during hot forging and rolling and cold rolling with intermediate annealings. The contamination was closely controlled during the operations. Heating for the hot deformation of zirconium was investigated in salt baths and in air. The methods of heating used to soften the metal for cold working and the properties of the metal after various treatments are described. (J.S.R.)

2250
DEVELOPMENT OF THE MECHANICAL CHARACTERISTICS AND STRUCTURE MODIFICATION IN THE COURSE OF ANNEALING SHEETS OF TITANIUM COLD-WORKED BY ROLLING. A. Saulnier and R. Develay. pp. 89-101 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

An investigation was made to determine the conditions of recrystallization of sheets of commercial cold-rolled titanium. It was found that titanium cold-rolled 50% and annealed for 30 min recrystallizes between 550 and 600°C. This recrystallization is a complex type produced chiefly by the migration of the grain and macle joints of the cold-worked product. There is some evidence of recrystallization by germination and growth of small polygonous grains. The mechanical characteristics show a restoration before there is any evidence of recrystallization. Titanium cold-rolled 150% has a confused and disordered micrographic structure. After 30 min annealing, it recrystallizes at 550°C with complete modification of the micrographic aspect and the appearance of a fine polygonous grain structure. This grain increases rapidly if the annealing temperature is raised. The mechanical characteristics are restored before the appearance of the first signs of recrystallization. The results of a micrographic and electron diffraction study of the recrystallization of thin foils removed from titanium sheets cold-worked 150% without annealing and with annealing at 500 and 600°C for 30 min are reported. There is a strong distortion of the reticular planes with a tendency to fragmentation of the crystal into fine cells very poorly defined. With annealing the cells are individualized and they have a tendency to return to a ordered crystalline state. (J.S.R.)

2251
RECRYSTALLIZATION OF COBALT H. Bibring and F. Sebilleau. pp. 103-109 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

The allotropic transformation of cobalt which is completely reversible when the cobalt is in a massive state shows a strong hysteresis for cobalt powders and filings. The recrystallization and polygonization were investigated on three kinds of cobalt samples: cobalt powders, cobalt ingots cast either in vacuum or argon atmosphere and cold-worked by rolling or hammering, and cobalt ingots cold-worked by abrasion with emery cloths. The details of the experiments are given. The results showed that the lowest temperature of recrystallization is 350°C, much lower than the temperature of allotropic transformation, the crystallization is accompanied by the appearance of a residual cubic phase at room temperature, and if the recrystallization treatment destroys the cold-working structure, the repetition of polygonization annealings and then recrystallization preserves the cold-working structure. (J.S.R.)

2252
MICROGRAPHIC OBSERVATION OF THE RECRYSTALLIZATION AT LOW TEMPERATURES OF ZONE MELTED ALUMINUM. Ph. Albert and O. Dimitrov. pp. 111-13 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

To observe directly the structures formed during the recrystallization of zone-melted aluminum at low temperatures, a technique of electrolytic polishing and anodic oxidation was used. The technique was applied to Al samples cold rolled at low temperatures to a 97% reduction rate and annealed at −48°C and −38°C for various times. The use of this method allowed direct observation of the shape and morphology of crystals formed at low temperatures. The possibility was shown of large displacements of atoms which involve the germination and growth of crystals in the cold-worked metal. (J.S.R.)

2253
COMPETITION BETWEEN RECRYSTALLIZATION AND POLYGONIZATION IN PURE ALUMINUM AND SOLID SOLUTIONS OF ALUMINUM−ZINC. MICROGRAPHIC EVIDENCE OF POLYGONIZATION. J. Montuelle. pp. 115-124 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

It is shown that a competition between recrystallization and polygonization can be observed in pure aluminum and in solid solutions of aluminum−zinc. Foreign atoms, such as iron and lithium, appear to play an essential role. The method of dynamic annealing of Al with a purity higher than 99.9% always leads to the polygonized structure. The absence of impurities permits the arrangement of dislocations in sub-joints before any recrystallization develops. It is shown that the light cold-working of a monocrystal will cause polygonization to appear after annealing and that there is no recrystallization whatever the length of thermal treatment. (J.S.R.)

2254
COMPETITION BETWEEN THE PHENOMENA OF POLYGONIZATION AND RECRYSTALLIZATION IN THE CASE OF PURE IRON. Jean Talbot. pp. 125-6 in "Symposium on Special Metallurgy held at Saclay June 27-28, 1957." 130p. (In French)

A brief summary is given of the investigation of polygonization and recrystallization in iron. Small quantities of carbon were introduced into annealed iron bars by heating them with carbon in a furnace with a large temperature gradient. At one end of the bar the carburization was approximately 0.010% and at the other end of the bar it was 0.050%. The bar was then lengthened 3% and annealed in hydrogen at 850°C for 72 hours. It was observed that the recrystallization with large grains was produced suddenly in a zone where the amount of carbon was initially 0.030%. The region of the bar where the initial carbon content was very low had small grains which were all polygonized. The large crystals present no sub-structure when the small crystals are polygonized. A prolonged annealing does not modify the equilibrium between the recrystallized zone with large grains and the polygonized zone. (J.S.R.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

2255 BNL-3797
Brookhaven National Lab., Upton, N. Y.
SURVEY OF THE 25 BEV SYNCHROTRON AT BROOKHAVEN NATIONAL LABORATORY. O. S. Reading. July 22, 1958. 10p. $1.80(ph OTS); $1.80(mf OTS).

The construction of a 25-Bev synchrotron at Brookhaven National Laboratory requires the location of 240 magnets around a circle one half mile in circumference within one tenth millimeter of their specified positions. The special devices and modifications of existing first order surveying instruments adopted to obtain this high precision in the synchrotron survey are described. Length measurements of 33 meter intervals between the control survey stations are being made with a root mean square error of twenty microns and closure adjustments to angle measurements have been 0.08 sexigesimal seconds. (auth)

2256 MURA-LJL/KRS-1
Midwestern Universities Research Assn., Urbana, Ill.
PARTICLE ORBITS IN FIXED FIELD ALTERNATING GRADIENT ACCELERATORS. L. Jackson Laslett and Keith R. Symon. Apr. 24, 1956. 45p.

A theory of orbit stability applicable to FFAG accelerators is developed by assuming a specified set of closed equilibrium orbits lying in the median plane. Some approximate formulas which present a useful general picture of the properties of FFAG accelerators are discussed. (J.R.D.)

2257 UCRL-4815
California. Univ., Livermore. Radiation Lab.
A HIGH-CURRENT RADIO-FREQUENCY ION ACCELERATOR. William A. S. Lamb, Ross E. Hester, and Dean O. Kippenhan. Feb. 1957. 17p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

A radio-frequency ion accelerator is described which is capable of continuous currents of protons of 250 ma at an energy of 500 kev. The beam is less than 3 in. in diameter and has a divergence of less than 2° half angle. Operation of the machine accelerating deuterons to an energy of 1000 kev is also described. (auth)

2258
STABILITY AND ISOCHRONISM IN CYCLOTRONS WITH RADIAL FIELD. Francis Fer. Compt. rend. 247, 1097-8(1958) Oct. 13. (In French)

The general criteria for the stability and isochronism in cyclotrons with a radial magnetic field are derived. (J.S.R.)

2259
MEASUREMENT AND AUTOMATIC CONTROL OF THE ENERGY OF A 31 Mev BETATRON. U. Farinelli, F. Ferrero, and R. Malvano (Univ. of Turin). Nuclear Instr. 3, 218-22(1958) Oct.

A simple method to control the energy of a betatron is proposed. It compares a signal proportional to the average e.m.f. during the acceleration period derived from a measuring loop to a suitable reference voltage, and derives an error signal which operates small changes in the expansion time. (auth)

2260
PROPOSAL FOR A SOURCE OF POLARIZED PROTONS. A. Abragam and J. M. Winter (Centre d'Etudes Nucleaires, Saclay, France). Phys. Rev. Letters 1, 374-5(1958) Nov. 15.

In a cyclotron, protons are produced by ionizing hydrogen atoms in the center of the magnet. If these atoms arrive in the ionizing region in states where the component of the proton spin along the field (I_z) has one value only, say $+\frac{1}{2}$, completely polarized protons could be available for acceleration. The variation of the four energy levels of a hydrogen atom, $a(M_I = \frac{1}{2})$ and $b(M_I = -\frac{1}{2})$ E positive and $c(M_I = -\frac{1}{2})$ and $d(M_I = \frac{1}{2})$ E negative, as a function of the applied field is shown. It is relatively easy to separate, in an incoming beam of unpolarized hydrogen atoms, with a Stern-Gerlach device, those in states a and b from those in states c and d because of the large difference in magnetic moment. In the present proposal, once a beam of atoms distributed with equal populations between the states a and b has been obtained by a Stern-Gerlach device, all atoms in the b state are transferred into the d state by means of a radio-frequency field $H_1 \cos \omega t$ parallel to the field H_0, by the adiabatic passage method. All proton spins are then in the state $I_z = +\frac{1}{2}$. (W.D.M.)

PHYSICS AND MATHEMATICS

General

2261 AECU-3861
Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science and Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.
PROPERTIES OF NUCLEAR MATTER. L. C. Gomes, J. D. Walecka, and V. F. Weisskopf. Jan. 10, 1958. 58p. (Notas de Física, Vol. IV, No. 2). $9.30(ph OTS); $3.60(mf OTS).

An account is given of recent theories by Brueckner, Eden, Swiatecki, Bethe, and co-workers about the properties of nuclear matter, which is identical in content, but different in its method of presentation. This presentation tries to clarify the reasons for the applicability of the independent-particle model and to determine what particular features of the nuclear forces are responsible for the validity of this model. (auth)

2262 AECU-3871
Wisconsin. Univ., Madison.
INTERACTION OF NEUTRONS WITH OXYGEN AND A STUDY OF THE $C^{13}(\alpha,n)O^{16}$ REACTION. R. B. Walton, J. D. Clement, and F. Boreli. [1956]. 35p. Contract

[AT-11-1-GEN-7]. (M-6185). $9.30(ph OTS); $3.60 (mf OTS).

Measurements of the oxygen total neutron cross section from 3.5 to 4.4 Mev and the $O^{16}(n,\alpha)C^{13}$ reaction cross section from 4.0 to 5.2 Mev are presented. In a study of the $C^{13}(\alpha,n)O^{16}$ reaction the following quantities were measured: the 0° yield from 0.8 to 3.5 Mev, 29 and 146° yields between 2.0 and 3.5 Mev, and 47 angular distributions in the range from 1.0 to 3.5 Mev. Cross sections for the $O^{16}(n,\alpha)C^{13}$ and the $C^{13}(\alpha,n)O^{16}$ reactions are compared using the principle of detailed balancing. On the basis of the $C^{13}(\alpha,n)$ angular distributions spin assignments for 14 states of O^{17} between excitation energies 7 and 9 Mev are discussed, and in some cases relative parity assignments are made. Reduced widths of the states of O^{17} were derived from the results of the experiments on the $C^{13}(\alpha,n)$ reaction and the oxygen total neutron cross section. (auth)

2263 AECU-3878

Institute for Advanced Study, Princeton, N. J.

THE VECTOR INTERACTION IN BETA DECAY. Jeremy Bernstein and Robert R. Lewis. [1958]. 25p. $4.80 (ph OTS); $2.70(mf OTS).

Further experimental consequences of a beta-decay interaction generated by a conserved vector current, as proposed by Feynman and Gell-Mann, are studied. Utilizing the strong analogy between the conserved beta-decay current, and the conserved charge current, higher multipole corrections to the usual results for allowed transitions are computed, and are related to the corresponding electromagnetic transitions, as was first done by Gell-Mann. The effects calculated include corrections to spectral shapes, beta-gamma directional correlations, and beta-alpha directional correlations. A multipole expansion of the V-A interaction is carried out, including all those terms normally classed as allowed and second forbidden. Applications to several interesting transitions are discussed. (auth)

2264 AECU-3900

Illinois. Univ., Urbana. Electrical Engineering Research Lab.

RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON WAVELENGTH RANGE OF THE SPECTRUM. Quarterly Progress Report No. 10 [for] June 1, 1958 to September 1, 1958. P. D. Coleman, W. L. Emery, J. R. Baird, R. C. Becker, B. W. Hakki, J. J. Stafford, R. J. Strain, and A. W. Swago. Sept. 30, 1958. 55p. Contract AT(11-1)-392. $9.30(ph OTS); $3.60(mf OTS).

Work on the problems of developing a suitable CW millimeter-wave generator and appropriate detection and measuring techniques is described. Harmonic frequency multiplication is being used as the basis for the development of the generators. Ferrites, gas discharge, and semiconductor crystals are all being investigated as possible nonlinear elements in these multiplying devices. The crystal detector work received a new impetus with the arrival of InSb and InAs materials. Measurements on the dielectric resonators indicated that these devices hold great promise as frequency measuring devices in the millimeter range. (For preceding period see AECU-3797.) (W.D.M.)

2265 AERE-R/R-2688

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

ABSOLUTE FAST NEUTRON FLUX MEASUREMENTS IN WATER. R. N. Glover. Sept. 1958. 8p. $0.25(BIS)

Measurements of the fast neutron flux were made using the (n,p) reactions in aluminum and phosphorus and U^{233} and Th^{232} fission chambers. If the cross sections calculated in a previous report (A.E.R.E. R/R 2687) are applied, then it is shown that the values of the absolute fast neutron flux at a given distance in water deduced from measurements with each detector are in good agreement with one another over the range of distances for which cross sections are available. It is suggested that the general problem of measuring the fast flux in any medium where the spectrum shape might be expected to change with distance may be solved by a similar approach. (auth)

2266 AFOSR-TN-58-580

Massachusetts Inst. of Tech., Cambridge.

OPTIMIZATION OF SPACE VEHICLE DESIGN WITH RESPECT TO PROPULSION SYSTEM. Paul E. Sandorff. July 1, 1958. 11p. Contract AF49(638)-363. (AD-158402).

The best vehicle design solution can be achieved only by considering all components of the problem and optimizing over-all cost factors, and this design may not necessarily incorporate the obviously optimum propulsion system. Nevertheless it is useful to consider individual parts of the optimization problem, not only to determine which is best from immediate considerations, but what penalties are incurred by departing from this optimum. The approach used for assessing the propulsion system design is based on the use of the structure-plus-payload ratio and factors effecting engine weight. (W.D.M.)

2267 COO-248

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE VELOCITY OF SOUND IN A LIQUID CONTAINING GAS BUBBLES. H. B. Karplus. June 11, 1958. 41p. ARF Project No. A-097. Contract AT(11-1)-528. $1.25(OTS).

The velocity of sound in water containing air bubbles is very low. In pure water sound travels with a speed of 1500 m/s; this velocity decreases to 100 m/s in water containing 1% by volume of air. The minimum occurs at 50% volume concentration at which a velocity of 20 m/s is observed. For constant mass concentration the velocity is directly proportional to the ambient pressure over an appreciable pressure range. As a consequence, a slow pressure rise in such a medium becomes a shock wave very rapidly. On the other hand, shock waves are expected to be severely attenuated when passing through the medium. The heat exchange between bubbles and the water is very rapid so that there is no adiabatic temperature rise due to the compression. For this reason the results may be readily extended to other gases which do not condense but are inapplicable to vapor (steam) bubbles. (auth)

2268 IFA-FT-29

Academia R. P. R. Institutul de Fizică Atomică, Bucharest.

PARALLEL SUSCEPTIBILITY OF AN ANTIFERROMAGNETIC WITH TWO MAGNETIC SUBLATTICES AT LOW TEMPERATURES. (Susceptibilitatea Paralelă a Unui Antiferomagnetic Cu Doua Subretele de Magnetizare la Temperaturi Joase). A. Corciovei. 1958. 7p.

This investigation deals with the parallel susceptibility, at low temperatures, of an antiferromagnetic consisting of two magnetic sublattices, having a single

axis of spontaneous antiferromagnetism, and for which the superexchange interactions are negligible. Holstein's and Primakoff's formalism is used. Their results are in good agreement with other investigators. In the present investigation another method for calculating $X_{11}A$ is given. For this purpose the hamiltonian is divided into: the unperturbed hamiltonian, H^0, corresponding to the absence of the magnetic field and containing the exchange term H_{ex} and the anistrophy term H_{anis}; and the perturbation hamiltonian H^1, caused by the field and involving the Zeeman term H_{ze}. Knowing the energy levels of the hamiltonian H^0 in the absence of the field, levels that will be degenerated, the degeneracy is eliminated and the corrected levels are computed using the perturbation theory, the perturbing term being H^1. Knowing the perturbed levels, the partition function and the parallel susceptibility are calculated. The results obtained are not different from those obtained by other authors. (A.C.)

2269 LAMS-2125

Los Alamos Scientific Lab., N. Mex.

THE VISIBLE RADIATION FROM HELIUM IN A STRONG SHOCK WAVE. Glenn E. Seay. Jan. 1957. 105p. Contract W-7405-eng-36. $16.80(ph OTS); $5.70(mf OTS).

Temperatures of about 20,000°K with ion densities ranging from about 10^{17} to 10^{18} cm^{-3} have been produced in helium by means of shocks. Shock waves having sufficient strength and planarity were obtained by reflection against a glass plate of initially strong shock waves produced by high explosives. Equilibrium calculations based on smear camera velocities of accurately plane shocks were used to determine the state of the gas behind the reflected shock wave. The light emitted consisted of a continuum on which were superimposed some shifted and broadened lines of the normal helium spectrum and some shifted and broadened forbidden lines. This light was recorded both on time-integrated and time-resolved spectrograms. The time-resolved spectrograms showed evidence of a measurable relaxation time at the shock front but no evidence of significant radiative cooling of the gas behind the shock. Experimental data on line profiles and shifts compared favorably with those predicted theoretically on the basis of a slowly varying field due to the ions combined with the collision effects of the electrons. In addition, it was necessary to consider self-absorption broadening to explain the observed shape of the strong line at 5876 A. Wave lengths and intensities of two forbidden lines were also found to be predictable in terms of the ion density, electron density, and temperature. (auth)

2270 NDA-2092-9

Nuclear Development Corp. of America, White Plains, N. Y.

PENETRATION OF NEUTRONS FROM A POINT FISSION SOURCE THROUGH BERYLLIUM AND BERYLLIUM OXIDE. H. Goldstein and H. Mechanic. June 23, 1958. 27p. For General Electric Co. Aircraft Nuclear Propulsion Dept. Subcontract (AT-74)-ANPG-05339. $4.80(ph OTS); $2.70(mf OTS).

Moment calculations have been performed to study the penetration of fission spectrum neutrons through Be and BeO. Flux distributions as a function of energy and penetration depth and doses as a function of penetration depth have been obtained for both materials. A heat deposition curve for Be has also been obtained, and effective relaxation lengths have been calculated for the doses in both Be and BeO. (auth)

2271 NP-7014

Purdue Univ., Lafayette, Ind.

DIFFUSION IN GAS MIXTURES TO 1000 ATMOSPHERES. Final Report for September 15, 1955–September 15, 1958. T. R. Mifflin and C. O. Bennett. 148p. OCR Project No. ORDOR-AC-P-1537/A18637. Contract DA-33-008-Ord-1218.

The coefficients of self-diffusion for argon were measured at 49.4°C and from 68 to 291 atmospheres in two different diffusion cells. In both cells the diffusion of the radioactive isotope, Ar^{37}, through ordinary argon was measured, and the results were corrected for the mass difference between the Ar^{37} and the ordinary argon. The results from the porous plug cell measurements showed that the product of the gas density and the self-diffusion coefficient varied with the density. In the annular path cell the coefficient was measured directly and without the assumptions required with the porous plug cell determinations. The gas in this cell, however, was subject to convection, and the coefficients measured with this cell checked only roughly with those measured in the porous plug cell. (auth)

2272 NP-7036

Case Inst. of Tech., Cleveland.

SINGLE CRYSTAL ELASTIC CONSTANTS OF LITHIUM. Technical Report No. 24. H. C. Nash and Charles S. Smith. July 1958. 21p. Project No. NR-017-611. Contract Nonr-114103.

The elastic constants of single-crystal lithium were measured by the ultrasonic pulse-echo technique. These results are compared with Fuchs' theoretical calculation of the Coulomb contribution to the shear stiffness of the alkali metals, which in lithium is the only significant contribution. Extrapolation of the experimental values to absolute zero gives values for both C_{44} and $(C_{11}-C_{12})/2$ which are lower than the corresponding theoretical values. The extrapolated anisotropy, $C_{44}/(C_{11}-C_{12})/2$, is higher than the value predicted by the theory. (auth)

2273 NYO-6562

Syracuse Univ., N. Y. Research Inst.

AIR SHOWER OBSERVATIONS BETWEEN 5,200M AND 3,260M ALTITUDE. Kurt Sitte, Irving L. Kofsky, Don L. Stierwalt, Susanna Lehrer, Klaus Tausk, and Andrea Wataghin. July 1957. 40p. Contract AT(30-1)-627. (PHY-90-577F). $6.30(ph OTS); $3.30(mf OTS).

In a study of the development of extensive air showers in the atmosphere, a hodoscope experiment was carried out at three mountain stations: Chacaltaya (5,200m), Mt. Evans (4,300m), and Echo Lake (3,260m). Six trays containing a total of 80 counters were used to determine the size and the lateral distribution of the showers. Four other trays with 54 counters and four liquid scintillators served to measure the transition effect of the shower electrons in lead, and thus to determine the age of the showers. The events could then be grouped and analyzed according to both age and size. The lateral distribution of showers of different age (as determined from the transition effect), both near the core and at larger distances, showed very little variation with altitude and with age. Near the core it is flatter than outside, and the flattening extends at all altitudes over an equal distance. Apparently this phenomenon is due to the continuous effect of the nucleonic component. The attenuation of the shower rate, at fixed geometry, is practically constant between 5,200 and 3,260m, the attenuation mean free path between Mt. Evans and Chacaltaya for the youngest showers being (155 ± 12)

g/cm^2 against an average of about 140 g/cm^2. The attenuation of the particle numbers in showers of equal frequency was over the whole range exponential with a mean free path of about 125 g/cm^2. The interaction mean free path of the shower primaries, determined from a comparison of the rates of showers of equal size and age at the three stations, was (87 ± 7) g/cm^2. This suggests that the shower primaries, in the energy region concerned (about 10^{15} ev), are predominantly protons. (auth)

2274 ORNL-2565
Oak Ridge National Lab., Tenn.
APPLICATION OF HINDERED SETTLING TO PARTICLE SIZE MEASUREMENT. J. M. DallaValle, J. P. McBride, V. D. Allred, and E. V. Jones. Nov. 14, 1958. 20p. Contract W-7405-eng-26. $0.75(OTS).

The settling of relatively concentrated suspensions of fine particles can be analyzed theoretically by analogy to a fluid moving up through a static bed of packed particles. Using this analogy an equation was developed describing the hindered settling phenomena in terms of a relation between two dimensionless groups—the Froude group and the Reynolds group—which correlated the data for the settling of suspensions of materials with densities from 1.1 to 4.0 g/cc and particle sizes from 8 to 1000 microns. The equation also permits the specific surface diameter of the suspended particles to be calculated from the hindered settling rate. Application of the equation to the settling of aqueous suspensions of a thorium oxide preparation calcined at various temperatures indicated the specific surface diameter of the suspended thoria increased with increasing calcination temperature from 4 microns at 650°C to 7.2 microns at 1300°C. (auth)

2275 ORNL-2614
Oak Ridge National Lab., Tenn.
SOLID STATE DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING AUGUST 31, 1958. Nov. 20, 1958. 188p. Contract W-7405-eng-26. $3.00(OTS).

The effect of 14-Mev neutron irradiation on the lifetime of current carriers and the conduction electron removal rate of germanium was investigated. Single-crystal n- and p-type germanium plates were exposed to the 1.17 and 1.33 Mev gamma rays of Co^{60}. Radiation effects on the etching behavior of germanium was studied Magnetic susceptibility of manganese sesquioxide and unirradiated and neutron-irradiated n-type silicon was investigated. The introduction rate of deep traps in an originally 12 ohm-cm phosphorus-doped silicon sample is 1.1×10^{-3} levels per Co^{60} photon per cm. The effects of neutron irradiation of InAs, quartz, and silica were investigated. The low-temperature thermal conductivity of lithium fluoride crystal after irradiation by thermal neutrons and Co^{60} gamma rays was measured. The thermal conductivity of NaF and CsI crystals was measured. The release of stored energy of graphite taken from the lattice of the ORNL Graphite Reactor was measured. A study of the amplitude-independent internal friction and Young's modulus in copper from 14°K to room temperature, both before and after neutron irradiation, was made. The temperature dependence of the critical shear stress of a neutron irradiated single copper crystal was measured. Isochronal annealing studies were made on high-purity Be and Mg neutron irradiated at 19.5°K. An investigation was made of the polygonization of copper by using etch pits and x-ray diffraction to observe polygonization. The possibility of measuring the rate of deuterium diffusion in copper was investigated. Electrical resistivity measurements on Al—Cu alloys are described. Mechanical yielding at 78 and 300°K in unirradiated and fast neutron irradiated copper single crystals was studied. The behavior of irradiated iron alloys is discussed. The stress-rupture life of tube-burst specimens of Inconel in air was determined in the MTR at several stresses at 1500°F. The Np^{237} and U^{238} fission reactions and the $S^{32}(n,p)P^{32}$ reaction are compared as relative monitors for radiation damage effects caused by displacements. The reactor and gamma irradiation of polymers are compared. The effect of molecular orientation on cross-linking or scission by radiation in amorphous polymers was investigated. A technique is described for measuring the temperature coefficient of the Young's modulus of ceramic specimens. Energy absorption in graphite and a hydrogen containing material was measured with a small calorimeter in the ORNL Graphite Reactor. Fission gas evolution was measured from UO_2 of 96% theoretical density irradiated at 1700°, and the rate was found to be of the order of 1% of the production rate. A UO_2 fuel plate clad with $Cr-Al_2O_3$ was examined after irradiation at 1800°C to 14.5% U^{235} burnup. A study of volatility behavior of Mo indicates that MoF_5 is converted to MoF_6 by fluorine. MoF_6 and Tc are adsorbed on NaF at 100°C, TcF being more strongly adsorbed than MoF_6. The Inconel in-pile forced-circulation fused salt loop operated for 235 hr at 1600°F in the LITR was examined for corrosion. Investigation of the holdup or retention of gaseous fission products was continued. (For preceding period see ORNL-2413.) (W.D.M.)

2276 RM-2271(RAND)
RAND Corp., Santa Monica, Calif.
CORRELATION ENERGY OF A DEGENERATE ELECTRON GAS. Richard A. Ferrell. Sept. 5, 1958. 24p. (AD-156049).

The general properties of the ground state of a degenerate interacting electron gas are discussed. An attempt is made to deduce as many general features of this gas as possible, independently of any approximations or calculations. It is shown that one case is unique and especially promising from this point of view—the case of the Coulomb interactions. It is proved that the correlation energy vs. density sets in monotonically as the density of this gas is increased. (auth)

2277 UCRL-4938
California. Univ., Livermore. Radiation Lab.
UTILIZATION OF THE SURFACE TENSION OF LIQUID METALS IN MAKING HIGH-VACUUM SEALS. Norman Milleron. Aug. 30, 1957. 12p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The free energy (surface tension) of a liquid film can withstand atmospheric pressure across a maximum theoretical gap of 10^{-3} cm between solids if the liquid wets and bridges the sides of the gap continuously. The eutectic alloy of Ga, In, and Sn is used for this purpose. This alloy is molten at room temperature with surface tension > 500 dynes/cm, vapor pressure < 10^{-6} cm at 500°C, and excellent wetting properties. This alloy can be utilized in valves, motion seals, flanged joints, and for electrical contacts mounted in any position. Using ultrasonic soldering techniques without heat or flux this alloy is readily wetted on W, Mo, Ta, pyrex, quartz, and certain ceramics. These materials will withstand the corrosive action of this alloy at at least 400°C. Some de-wetting has been observed with only the nonmetals at

high temperatures. This de-wetting may be due to thermal decomposition of gallium oxide. Stainless steel is easily wetted, but is attacked at temperatures above 300°C. Copper and brass are attacked at room temperature. (auth)

2278 UCRL-5281

California. Univ., Los Angeles. Inst. of Geophysics and California. Univ., Livermore. Radiation Lab. TEMPERATURES AND PRESSURES ASSOCIATED WITH THE CAVITY PRODUCED BY THE RAINIER EVENT. G. C. Kennedy and G. H. Higgins. July 1958. 9p. Contract W-7405-eng-48. $0.50(OTS).

Examination of core samples and radiochemical data from the Rainier shot indicates that, between 30 seconds and two minutes after the explosion, the cavity was filled with steam at 40 atmospheres and 1500°C. It had a lining of molten rhyolite, with very steep temperature gradients to the unfused tuff. The steam escaped at one or, at the most several, fissures, without carrying any radioactivity to the surface, and the reduction in pressure permitted the cavity to collapse. (auth)

2279 UCRL-5323

California. Univ., Livermore. Radiation Lab. REACTION CROSS SECTIONS OF U^{238} IN THE LOW MEV RANGE. R. J. Howerton. Aug. 15, 1958. 5p. Contract W-7405-eng-48. $0.50(OTS).

Reaction excitation functions are presented for nonelastic, (n,n'), (n,2n), (n,3n), (n,f), and (n,γ) reactions for U^{238} in the energy range 0.5 to 14 Mev. (auth)

2280 UCRL-8480

California. Univ., Berkeley. Radiation Lab. A SIMPLE PULSED NEUTRON SOURCE BASED ON CROSSED-FIELD TRAPPING. Lawrence Ruby. Oct. 2, 1958. 9p. Contract W-7405-eng-48. $0.50(OTS).

A simple pulsed neutron source has been constructed which consists of an anode formed by a cylindrical-shell permanent magnet, and of two disk cathodes. One of the cathodes forms the neutron-producing target and the device is exhausted adjacent to the other. In operation, the anode is pulsed positive at 140 kv for 1 μsec at up to 200 pulses per sec. Ions are produced adjacent to the anode in a toroidal trapping region which exists as a result of the crossed electric and magnetic fields. The ionization is enhanced by the action of electrons reflecting through the inside of the magnetic shell. As a consequence of this trapping, large fluxes of soft x rays are created which may be injurious to personnel. (auth)

2281 WAPD-T-15

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh. THERMAL NEUTRON FLUX IN LAMINAR LATTICES. Milton Danzker. Sept. 1952. Decl. Sept. 8, 1958. 25p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70 (mf OTS).

The one-group transport equation with sources has been used to obtain an analytic solution for an infinite periodic lattice with an arbitrary number of lamina per period. The solution is most useful for media which are quasi-homogeneous, in a nuclear sense. The thermal utilization of the lattice is calculated and the result is compared with ordinary diffusion theory. The change in thermal utilization which accompanies the introduction of a small amount of heterogeneity into a medium, keeping the average composition the same, is shown to be badly underestimated by ordinary diffusion theory. The effect of the distribution in energy of thermal neutrons is discussed in connection with a simplified model based on the concept of the self-shielding factor. (auth)

2282 USNRDL-TR-272

Naval Radiological Defense Lab., San Francisco. PENETRATION OF PLANE NORMAL AND PLANE SLANT GAMMA RAYS THROUGH SLABS OF ALUMINUM AND STEEL. I. ANGULAR AND ENERGY DISTRIBUTIONS (EXPERIMENTAL PULSE HEIGHT). N. E. Scofield, R. L. Lynn, and W. E. Kreger. Oct. 31, 1958. 50p.

Measurements have been made of the scattered gamma radiation emerging from slabs of aluminum and steel exposed to Co^{60} and Cs^{137} gamma radiation with plane normal and plane slant (only for Co^{60}) incidence. The measurements were made using a 4-in. diameter by 4-in. long NaI(Tl) scintillation detector unit with a lead shield and collimator. Pulse-height spectra were recorded in a 100-channel analyzer for detection angles of 5, 10, 20, 30, 45, and 60° for the normal incidence case. Slab thicknesses used were from 1 to 5 mean free paths for the primary source gamma radiation (1 to 5 inches of steel and 3 to 15 inches of aluminum for Co^{60}, $\frac{3}{4}$ to $3\frac{3}{4}$ inches of steel and 2 to 10 inches of aluminum for Cs^{137}). Slant angles of radiation incidence were −50, −40, 20, 30, and 40°. Corrections are discussed and results are plotted as families of pulse-height distributions for the various materials, source energies, etc. General conclusions are drawn from the data. (auth)

2283 AEC-tr-3352

THEORY OF STABILITY OF MOTION. I. G. Malkin. Translated from a publication of the State Publishing House of Technical-Theoretical Literature, Moscow–Leningrad, 1952. 461p. $4.75(OTS).

An exposition of the theory of the stability of motion and its methods is presented. The application of the theory to the solution of practical and concrete problems is demonstrated. The author not only covers basic questions of theory but also discusses certain details of individual problems. The concentration method of presentation is followed. The first concentric group consists of Chapters I, II, and III. The statement of the question is given in these chapters. Basic theorems of Lyapunoff's second method for stabilized motions and the theory of stability by first approximation for stabilized motions are discussed. Chapter six is devoted to the general case of unstabilized motions. (A.C.)

2284 AEC-tr-3449

LAUNCHING OF THE FIRST ARTIFICIAL SATELLITES. A. N. Nesmeianov. Translated by the Oak Ridge National Lab. Library Staff from Vestnik Akad. Nauk S.S.S.R. 28, No. 1, 5-7(1958). 6p.

Highlights of Soviet scientific development from the discovery of the periodic system of elements in 1869 are presented. Several scientific achievements, including the first airplane flight in 1882 and the first demonstration of wireless telegraph in 1896, are discussed. Finally a discussion of Sputnik launched Oct. 4, 1957, is presented. No data are included, and the discussions are general with emphasis on the excellence of Soviet scientific achievement. (J.R.D.)

2285 AEC-tr-3451

MEASUREMENT OF NEUTRON SPECTRA IN THE FISSION OF U^{233}, U^{235}, Pu^{239} IN THE 50–700 kev REGION. V. P. Kovalev. Translated by Oak Ridge National Lab. Library Staff from Zhur. Eksptl'. i Teoret. Fiz. 34, 501-2(1958). 4p.

Neutron fission spectra were measured with a cloud chamber filled with water vapor and hydrogen to a pres-

sure of 210 mm of mercury. Samples of mixed uranium oxide and plutonium dioxide prepared in the form of disks 60 mm in diameter and 2.5 mm thick and irradiated by a beam of thermal neutrons were the fission sources. The ratio of the number of recoil protons in the interval 0.05 to 0.6 Mev was determined. The values of the ratios for U^{233}, U^{235}, and Pu^{239} are 0.49 ± 0.04, 0.53 ± 0.04, and 0.48 ± 0.04, respectively. (J.R.D.)

2286 AEC-tr-3452
DEVELOPMENT OF SEA WAVES FROM THEIR INITIATION TO THE PHASE OF MAXIMUM STEEPNESS. V. V. Shouleikin. Translated for Oak Ridge National Lab. from Doklady Akad. Nauk S.S.S.R. 118, 472-5(1958). 6p.

The scheme of the development of sea waves at the short initial stage was investigated. It is emphasized that a rigid theory has not been developed because small waves developing in the presence of a drift current system not established in the upper layer of the sea have not been analyzed. A generalized expression is developed with which wave steepness dependence on time may be expressed. (J.R.D.)

2287 AEC-tr-3469
EVALUATION OF THE ECONOMIC EXPEDIENCY IN USING SPECIAL, HEAVY CONCRETE FOR THE SHIELDING OF RADIATION. (Otsenka Ekonomicheskoi Tselesoobraznosti Primeneniya Spetsial'nykh Tiazhelykh Betonov dlia Zashchity of Izlucheniya). A. N. Komarovskii. Translated by Lydia Venters (Argonne National Lab.) from Atomnaya Energ. 4, 437-42(1958). 12p.

An evaluation was made of the economic expediency in using special, heavy concrete or ordinary concretes with mineral fillers for a biological shield for nuclear reactors and accelerators of charged particles. A survey was made of the literature. Comparative data on various types of concrete shielding are tabulated. Calculations on shielding efficiency are included. Based on the data collected it was concluded that the use of special, heavy concretes is expedient only in exceptional cases. (C.H.)

2288 BNL-3495
PRODUCTION OF HELIUM AND ARGON IN IRON BY HIGH ENERGY PROTONS. O. A. Schaeffer and J. Zähringer. Translated from Z. Naturforsch. 13a, 346-7(1958). 7p.

The cross sections for helium and argon isotope production in iron targets by protons at 0.16, 0.43, and 3.0 Bev energy were measured. The irradiation techniques and measurement methods are described, and the results are presented in tables. The He^3 and Ar^{38} cross sections are compared with amounts found in meteorites. (J.R.D.)

2289 NP-tr-70
ON THE MOTION OF IONS AND THE CONTOUR OF THEIR LINES IN THE POSITIVE COLUMN OF THE DISCHARGE. I. THE DIRECTED MOVEMENT OF IONS IN A DISCHARGE OF LOW PRESSURE. Yu. M. Kagan and V. I. Perel. Translated for U.K.A.E.A. Atomic Energy Research Establishment from Optika i Spektroskopiya 2, 298-303(1957). 10p.

The function of the distribution of ions over velocities on the axis of the positive column of a discharge at low pressures was found using the kinetic Boltzmann equation. Expressions were obtained for the velocity of drift and the mean square of the velocity of ions in the direction of a longitudinal electric field. The form of the Doppler contour of the lines of ions was obtained by observation along the axis of the tube. (auth)

2290 NP-tr-168
BASIC TERMINOLOGY AND DEFINITIONS IN THE TECHNIQUE OF AUTOMATIC DIGITAL MACHINES. E. I. Mamonov. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Vychislitel'naya Tekh., 140-50(1958). 21p.

The absence of standard terminology in Soviet electronic automatic digital computers is the reason for much misunderstanding. The principal requirements to be used as a guide in selecting the standard terminology are presented. In addition, a list of words and phrases with definitions is included. (J.R.D.)

2291 NP-tr-171
STUDY OF THE RELATION BETWEEN THE ELECTRICAL CONDUCTIVITY AND THE ADSORPTIONAL AND SENSITIZING PROPERTIES OF ZINC OXIDE. II. ELECTRONIC PROCESSES IN ZINC OXIDE IN GAS PHASE CATALYSIS AND PHOTOCATALYSIS. I. A. Myasnikov. Translated by R. C. Murray (U.K.A.E.A. Atomic Energy Research Establishment) from Zhur. Fiz. Khim. 31, 2005-11(1957). 13p.

Part I available as AEC-tr-3301.

The kinetics of zinc oxide electrical conductivity in oxygen photodesorption was studied, and the dependence of this electrical conductivity in the presence of oxygen on the illumination intensity. (W.L.H.)

2292 NP-tr-174
THE EFFECT OF RADIAL CLEARANCE ON THE WORKING OF AN AXIAL COMPRESSOR. S. P. Livshits. Translated from Energomashinostroenie No. 1, 14-18(1956). 9p.

This article describes the results of a study of the effect of radial clearances on the pattern of flow in an axial compressor stage. The qualitative changes in the velocity and pressure distributions are revealed. The characteristics and range of stable operation in a stage affected by radial clearances are demonstrated. (auth)

2293 NP-tr-176
EXPERIMENTAL CONFIRMATION OF THE THEORY OF ELASTIC SCATTERING OF HIGH-SPEED ELECTRONS. I. I. Iamzin and Z. G. Pinsker. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Doklady Akad. Nauk. S.S.S.R. 65, 645-8(1949). 7p.

The intensities of the maxima on electron diffraction pictures from polycrystalline Al, Cu, Ag, Au, Sn, Zn, and Mg were measured by a photographic method. The mathematical expression for computing the intensity is presented. It is concluded that the atomic and kinematic scattering theories are applicable for light and heavy elements of the periodic system when electrons with 38 to 56 kev energies pass through films with an average rated thickness of up to 5×10^{-6} cm. (J.R.D.)

2294 NP-tr-177
SOFT X-RADIATION FROM THE QUIET SOLAR CORONA. Gerhard Elwert. Translated by W. G. Oischer (U.K.A.E.A., Atomic Energy Research Establishment) from Z. Naturforsch 9a, 637-53(1954). 56p. (Tables omitted).

Particle densities of ions in the ionization stages under consideration were determined for elements of great cosmic abundance. The radiation produced by photorecombinations and free-free transitions gives rise to a continuous emission spectrum which has a maximum of 30 to 50 A. The higher intensity given by line emission, whose maximum is at longer wave-

lengths, is discussed along with electron collisions as an excitation mechanism. Born's collision theory is used for the calculation of effective cross sections. Spectra from the radiation by the quiet corona at various temperatures are shown, and the validity of the ionization formula used is checked by the calculated characteristic radiation of the corona. In addition, the function of x radiation in the formation of the normal ionospheric E-layer is interpreted. (auth)

2295 SCL-T-202

A NEW METHOD OF TEMPERATURE MEASUREMENT IN HIGH TEMPERATURE ARC COLUMN DISCHARGES. PART II. (Eine neue Methode zur Temperaturmessung an hochtemperierten Bogensäulen. II. Teil). Hans Bartels. Translated by Marcel Weinreich (Sandia Corp.) from Z. Physik 128, 546-74 (1950). 35p.

In Part I the general foundations for a method which determines the temperature in arc column discharges from the contours of suitable lines occurring in self-reversal are developed, whereby this basis provided a procedure that requires only a minimum of presuppositions and thus permits achieving merely a rough estimate. Part II presents a systematic development of the possibilities to make the evaluations more precise and definite. Evaluation methods are obtained for the measurement of the temperature distribution where the evaluation error becomes smaller than the experimental error caused by measuring of intensity. (auth)

2296 SCL-T-207

ON THE QUESTION OF DETERMINING THE BOUNDARIES (POSITION) OF THE TROPOPAUSE. (K voprosu Opredeleniya Granits Tropopauzy). G. I. Kogan-Beletskii (Kogan-Beletskiy). Translated by Marcel I. Weinreich (Sandia Corp.) from Meteorol. i Gidrol. No. 12, 36-9(1957). 10p.

The boundaries and position of the tropopause were investigated. It is pointed out that a complex analysis of the spatial structure of the tropopause may be carried out with the aid of vertical atmospheric cross sections, barometric high-level topographies, synoptic surface charts, and aircraft reports. Another aid includes data from radio observations of altitudinal wind. Phenomena which are associated with tropopause boundary include the characteristic diminished vertical temperature gradient fluctuating between 0.6 and 0.1°C per 100 meters, and the characteristic minimal temperature surface, where the relative humidity attains its maximum value. In addition, a number of other supplementary data are given which may be helpful in attaining a fuller knowledge of the tropopause make-up. (J.R.D.)

2297 UCRL-Trans-299

REACTIONS PRODUCED BY μ MESONS IN HYDROGEN. Ya. (Ia.) B. Zel'dovich. Translated for Univ. of California Radiation Lab. from Doklady Akad. Nauk S.S.S.R. 95, 493-6(1954). 8p.

2298

DIFFUSION IN A PORE OF VARYING CROSS SECTION. E. E. Petersen (Univ. of California, Berkeley). A. I. Ch. E. Journal 4, 343-5(1958) Sept.

The ratio of the effective to the normal diffusivity of a material diffusing within porous solids is less than unity. In the simple theory the porosity and tortuosity, or labyrinth, factors are used to explain the magnitude of this ratio and to account, respectively, for the reduced cross-sectional area and the increased diffusion distance. However, abnormally large values of the tortuosity factor are obtained from experimentally measured effective diffusivities within pelleted or extruded porous solids. This work is concerned with the quantitative effect of periodic pore constrictions on the effective diffusivity. The pore model assumed for this study is a hyperbola of revolution giving a pore constriction at the vertex of the hyperbola. Solutions to the steady state diffusion equation in a pore of this shape were obtained at various values of β, the ratio of the maximum to the minimum cross-section in the pore. Comparison of the rate of diffusive transport in this pore and an equivalent cylindrical pore indicates that δ, the ratio of the effective to the normal diffusivity, is about 0.33 at $\beta = 25$ for large pores. At the same value of β, δ would be smaller for diffusion in the Knudsen region. (anth)

2299

A SINGLE CRYSTAL NEUTRON DIFFRACTION STUDY OF DIASPORE, AlO(OH). William R. Busing and Henri A. Levy (Oak Ridge National Lab., Tenn.). Acta Cryst. 11, 798-803(1958) Nov.

A single-crystal neutron-diffraction study of diaspore has been made in which the intensities of ninety reflections of the hk0 and 0kl zones were measured. Unit-cell dimensions and their standard errors as redetermined by the x-ray powder method are a = 4.401 ± 0.001, b = 9.421 ± 0.004, and c = 2.845 ± 0.001 A. The structure was refined by the method of least squares using an anisotropic temperature factor for each atom. The Al and O position parameters obtained in this way are in good agreement with the x-ray results reported by Hoppe. The hydrogen bonding postulated by Ewing (1935) was confirmed. The H atom is located 0.990 A from O_{II}, but is not on the line of centers between O_I and O_{II}. Instead the O_{II}–H bond makes an angle of 12.1° with the O_{II}–O_I vector. (auth)

2300

AN ANALYTIC FORMULA FOR THE THEORY OF THE FORMATION OF THE ELECTRON GROUPS IN THE PERIODIC SYSTEM OF THE ELEMENTS. T. Tietz (Univ. of Lodz, Poland). Acta Phys. Acad. Sci. Hung. 9, 73-7(1958). (In German)

An analytical formula is presented for the lower range of Z values in which s, p, d, and f electrons first appear. This analytical formula agrees well with the atomic number in which these electron groups begin to fill up. (tr-auth)

2301

A TABLE FOR COMPUTING TRIVARIATE NORMAL PROBABILITIES. George P. Steck (Sandia Corp., Albuquerque, N. Mex.). Ann. Mathematical Statistics 29, No. 3, 780-800(1958) Sept.

A table for computing trivariate normal probabilities is given. A summary of the formulas used, a derivation of the relationship between the trivariate normal integral and the tabulated function, a description of the table, a numerical example, and an extension of the method to higher dimensions are also given. (T.B.A.)

2302

ON THE L-AUGER LINES IN THE BETA-RAY SPECTRUM OF THE ACTIVE DEPOSIT OF THORON. Ziemowid Sujkowski and Hilding Slätis (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 14, 101-21(1958).

A brief review of earlier works on L-Auger lines in the beta-ray spectrum of ThB + C + C" is given. The L-Auger lines in the beta-spectrum of the thoron active

deposit were recorded photographically in a permanent magnet beta-ray spectrometer at a high resolution (< 1 promille). 54 lines were found in the energy region 6 to 16 kev. A comparison of the position of these lines with the L-Auger lines found by earlier workers is given schematically. 47 lines were interpreted. The majority of the L-Auger lines belong to ThC(Bi^{212}), the rest are due to ThC″(Tl^{208}). The higher the resolution, the weaker (more diffuse) the thallium lines, because these arise from thallium nuclei recoiling after the α-emission of the parent nuclei ThC. The influence of the Coster–Kronig transition on the intensity of the lines is discussed. The decay scheme of ThB + C + C′ + C″ is considered and some corrections are introduced. (auth)

2303

ELECTROMAGNETIC RADIATION FROM ELECTRONS ROTATING IN AN IONIZED MEDIUM UNDER THE ACTION OF A UNIFORM MAGNETIC FIELD. R. Q. Twiss and J. A. Roberts (C.S.I.R.O., University Grounds, Chippendale, Australia). Australian J. Phys. 2, 424-46 (1958) Sept.

A theory is given for the radiation from a fast electron rotating, under the action of an external magnetic field, in an ionized plasma. It is shown that, although the radiation is emitted predominantly in the extraordinary mode, the ordinary mode is also weakly excited, even in the limiting case in which the density of the background plasma is vanishingly small. At the harmonics of the gyro frequency of the fast electron the power radiated in the ordinary mode is a few per cent of that radiated in the extraordinary mode. This ratio is independent of v_0, the velocity of the fast electron, as long as v_0 is sufficiently small compared with c, the velocity of light. However, at the fundamental gyro frequency the power radiated in the ordinary mode is lower by a factor $\simeq 10^{-2}(v_0/c)^4$ than that radiated in the extraordinary mode and indeed is significantly smaller than that radiated, in either mode, at the third harmonic. The gyro theory of the non-thermal radiation from the Sun is discussed in the light of these results and it is argued that this mechanism cannot explain the phenomena associated with the bursts of spectral types II and III. However, it is conceivable that the radiation on spectral type I may be of gyro origin, though even in this case there are serious objections to this explanation. (auth)

2304

ANISOTROPIC SMALL-ANGLE SCATTERING OF X-RAYS IN GRAPHITE. J. Auleytner and M. Lefeld. Bull. acad. polon. sci. Classee 3, 5, No. 3, 291-4(1957). (Translated from Referat. Zhur. Fiz., No. 3, 1958, Abstract No. 5847).

It is shown that the small-angle scattering of x rays in pressed specimens of powdered graphite, in which the crystallites have a definite orientation, is anisotropic. By taking into account the dimensions of the regions with electronic density it is concluded that the small-angle scattering is due, not to the grains of graphite, but to pores in these grains.

2305

HYPERFINE STRUCTURE OF THE FORBIDDEN Cd I LINE λ 3141 A.U. ($5s^2\ {}^1S_0 - 5s\ 5p\ {}^3P_2^0$). F. Leś and H. Niewodniczański. Bull. Acad. polon. sci. Classe 3 5, No. 3, 299-303(1957).

An attempt was made to prove, with respect to forbidden Cd I lines, the validity of the hypothesis that some forbidden spectral lines may come from the electric dipole radiation arising by the interaction between the magnetic moment of the nucleus of an atom and the electrons of its shell. To determine the isotopic structure of the 3141 A line, its hyperfine structure was experimentally examined. The microphotometric curve of the interference image of the line is composed of one fringe only. The conclusion was made that this Cd line is emitted solely by the odd isotopes Cd^{111} and Cd^{113}. (J.S.R.)

2306

HOW T AND P CHANGE GAS VISCOSITY. Wallace R. Gambill (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Chem. Eng. 65, No. 21, 157-62(1958) Oct. 20.

The temperature dependence of gas viscosity at low or moderate densities, where the viscosity rises with temperature, was investigated. Equations are presented for estimation of gas viscosity at other temperatures when the viscosity is known at a single temperature, and procedures for interpolation or extrapolation of two or more values of viscosity are given. In addition, five other methods of calculating the effect of temperature and pressure variation of gas viscosity are briefly considered. (J.R.D)

2307

HOW TO ESTIMATE ENGINEERING PROPERTIES TO GET VISCOSITY FOR A GAS MIXTURE. Wallace R. Gambill (Union Carbide Nuclear Corp., Oak Ridge, Tenn.). Chem. Eng. 65, No. 23, 157-60(1958) Nov. 17.

The various estimation methods with which mixture viscosities may be calculated from known pure-component viscosities are given. Separate treatment for low- and high-pressures is given. (T.R.H.)

2308

INFLUENCE OF THE ADSORPTION STATE ON THE K ABSORPTION SPECTRUM OF COBALT. Paul Sakellaridis. Compt. rend. 247, 876-9(1958) Sept. 22. (In French)

A comparative study of the K absorption spectra of cobalt given by the pure sulfate, chloride, nitrate, and acetate of cobalt and the spectra of the same materials adsorbed on magnesia shows an effect of the adsorption state on the X absorption spectra. Moreover, it is shown that in the mechanism of adsorption the anion of the cobalt salt plays an important role. (tr-auth)

2309

A NEW CORPUSCULAR RAY. Daniel Barbier, Jean Delannoy, and Gilbert Weill. Compt. rend. 247, 886-8 (1958) Sept. 22. (In French)

If the ray observed at 6708 A is the resonance ray of lithium, the ratio of the number of neutral lithium atoms to the number of neutral sodium atoms was evaluated at 0.006 in the high atmosphere. This ratio is of an order of magnitude comparable to the abundances of lithium and sodium in meteorites. (tr-auth)

2310

SOME PROPERTIES OF MIXED GARNETS OF DYSPROSIUM–YTTRIUM, DYSPROSIUM–GADOLINIUM, AND OF DYSPROSIUM–ERBIUM. Gérard Villers and Jean Loriers. Compt. rend. 247, 1101-4(1958) Oct. 13. (In French)

The values of the parameters of the crystalline lattice, the Curie points, and the compensation points are given for mixed garnets of dysprosium defined by the molecular relation $5Fe_2O_3 \cdot xYt_2O_3 \cdot (3-x)Dy_2O_3$, in which Yt designates yttrium, gadolinium, or erbium. The compensation points of these garnets are in good agreement with the theoretical values. (tr-auth)

2311

MEASUREMENT OF THE ELASTIC CONSTANTS OF LITHIUM FLUORIDE UP TO 750°C. Christiane Susse. Compt. rend. 247, 1174-7(1958) Oct. 20. (In French)

The three independent elastic constants of lithium fluoride crystals were measured by a resonance method at temperatures from 20 to 750°C. The results are tabulated and compared with previous results at 20°C. (J.S.R.)

2312

RADIAL PULSATIONS OF AN INFINITE CYLINDER IN THE PRESENCE OF MAGNETIC FIELD. J. N. Tandon (Indian National Committee for the I.G.Y., N.P.L., New Delhi) and S. P. Talwar (Delhi Univ., India). Indian J. Phys. 32, 317-22(1958) July.

The general equation governing the radial pulsations of an infinite cylinder having volume currents was derived and the integral formulas for the frequency of pulsations are deduced for two models of current density, viz., (i) circular currents and (ii) line currents. It is found that the cylinder remains dynamically stable for the two models of current systems. (auth)

2313

SOFT X-RAY EMISSION SPECTROSCOPY OF GRAPHITE AND THE SUGGESTION OF A SUITABLE BRILLOUIN ZONE FOR IT. Ajit Kumar Dutta (Indian Assn. for the Cultivation of Science). Indian J. Phys. 32, 397-9(1958) Aug.

X-ray emission spectra can furnish direct evidence regarding the band structure of solids. An attempt is made to utilize the available data to decide the proper Brillouin zone in graphite. The variation of N(E), density with the energy within a Brillouin zone, was obtained in the case of graphite from its soft x-ray spectra and is graphically shown. (A.C.)

2314

THE ZIRCONIUM–HYDROGEN SYSTEM: SOME THERMODYNAMIC PROPERTIES FROM A HEAT CONTENT STUDY. Thomas B. Douglas (Univ. of California, Berkeley). J. Am. Chem. Soc. 80, 5040-6(1958) Oct. 5.

The relative heat contents of zirconium and five zirconium hydrides (24 to 52 atomic % hydrogen) were precisely measured over the range 0 to 900°C. Appreciable hysteresis was observed only near the eutectoid temperature. After developing a method generally applicable to heterogeneous systems, the heats of isothermal hydriding throughout most of the range of temperature and composition investigated were derived. Several of the boundaries of the phase diagram also were derived from the thermal data and are found to be in reasonably good agreement with the published results found by other methods. The energies and relative stabilities of the high temperature crystalline forms are discussed qualitatively after estimating their disorder entropies. (auth)

2315

ELECTRICAL PROPERTIES AND THERMAL EXPANSION OF THE LAVES PHASES, $CaMg_2$ AND $MgCu_2$. J. F. Smith and J. R. Ogren (Iowa State Coll., Ames). J. Appl. Phys. 29, 1523-5(1958) Nov.

Electrical resistivities, temperature coefficients of resistivity, and Hall coefficients have been measured on single crystals of hexagonal $CaMg_2$ and on polycrystals of cubic $MgCu_2$. The magnitudes of the measured values fall in the range normally observed in metals. In contrast, measured values for the coefficients of thermal expansion are slightly higher than those observed in metallic elements. Appreciable scatter in measured resistivities on different specimens was observed and is presumably due to variations in the degree of crystalline perfection. For $CaMg_2$ the measured Hall coefficients and the temperature coefficients of resistivity and of thermal expansion show only a small degree of anisotropy. The sign of the Hall coefficients was found to be positive for $CaMg_2$ and negative for $MgCu_2$; this is consistent with previous measurements of magnetic susceptibility made on $MgCu_2$ and its alloys. (auth)

2316

CURRENT DISTRIBUTION IN MODULATED MAGNETICALLY FOCUSED ELECTRON BEAMS. M. Chodorow, H. J. Shaw, and D. K. Winslow (Stanford Univ., Calif.). J. Appl. Phys. 29, 1525-33(1958) Nov.

Detailed measurements have been made of the dc and rf current distribution in a modulated, magnetically focused electron beam having normalized parameters in the range of values appropriate for practical medium-power and high-power klystrons. The ratio of the total rf current to the total dc current in the beam as a function of drift distance was determined experimentally under Brillouin-flow conditions for selected values of α (the ratio of the rf voltage at the input gap to the dc beam voltage). These experimental values are compared with the results predicted theoretically. Similar experimental results are presented for higher focusing fields. Detailed radial distributions of the dc and rf current were experimentally determined by using an iris (a plate with a small hole) to allow only a small portion of the beam to be selected at any radial position. These measurements were made at various values of α and drift distance. The results for small values of α show, as predicted by theoretical considerations for a modulated Brillouin-flow beam, that the radial rf current distribution in the beam is the same as that of a beam whose modulation is represented as sinusoidal scallops on a beam of constant (volume) charge density. As either α or the focusing field, or both, are increased, the rf current is no longer confined to the beam periphery but becomes more evenly distributed throughout the beam cross section. (auth)

2317

ION INDUCED REEMISSION OF NOBLE GASES FROM A NICKEL SURFACE. J. H. Carmichael and E. A. Trendelenburg (Westinghouse Research Labs., Pittsburgh). J. Appl. Phys. 29, 1570-7(1958) Nov.

Each of the noble gases, He, Ne, Ar, and Kr, has been ionically pumped with an energy of about 100 ev into a nickel target and has been subsequently released by a similar bombardment using a different noble gas. A mass spectrometer permitted the measurement of both the reemission of the trapped atoms and the trapping of the bombarding particles. The reemission mechanism is described in terms of a simple model which assumes that the trapped atoms are released by the bombarding particles through a mechanism of sputtering of either the target material or the trapped gas or a combination of both. The experimental results are in agreement with the model. A direct replacement of a trapped atom from its trapping site by a bombarding particle is shown to be a relatively unimportant factor in the reemission process. Measurements of the reemission rates of the trapped atoms have yielded information concerning the

depth distribution of the trapped atoms in the nickel target. In particular, saturation of the depth distribution has been observed for Ne, Ar, and Kr at concentrations below one equivalent monolayer while He showed no such effects at the highest concentrations used, which corresponded to approximately 15 equivalent monolayers. (auth)

2318

DYNAMICS OF ELECTRON BEAMS FROM MAGNETICALLY SHIELDED GUNS. A. Ashkin (Bell Telephone Labs., Murray Hill, N. J.). J. Appl. Phys. 29, 1594-1604(1958) Nov.

The dynamics of electron beams from magnetically shielded guns is examined in detail both experimentally and theoretically. The electron orbits and beam shape variations are investigated with an electron beam analyzer which measures current density variations and transverse velocity. The existence of rings of charge that move through the beam and the gradual reduction in beam scalloping with length are demonstrated. It is shown that simple energy considerations plus an account of the role of transverse thermal velocities is sufficient to account for the experimentally observed features of beam behavior in the limit of negligible space charge. In the presence of space charge the beam behavior is qualitatively unchanged except for some defocusing and precession of the electron orbits provided that the magnetic field is at least several times the Brillouin field. (auth)

2319

MEASUREMENT OF REFLECTANCE AND EMISSIVITY OF GRAPHITE AT ARC TEMPERATURE WITH A CARBON ARC IMAGE FURNACE. M. R. Null and W. W. Lozier (National Carbon Co., Parma, Ohio). J. Appl. Phys. 29, 1605(1958) Nov.

A carbon arc image furnace for measurement of reflectance and emissivity at high temperatures is described. The radiation from the image furnace was allowed to fall on a sample of graphite, and measurement was made of the reflected fraction. Measurements showed that the crater surface at the arc temperature reflected approximately 2% of the incident light. This result corresponds to an absorption and emissivity of 98%. This value compares favorably with previous measured values. (A.C.)

2320

A NOTE ON "A NUCLEAR ELECTRIC PROPULSION SYSTEM." H. Preston-Thomas (National Research Council, Ottawa, Can.). J. Brit. Interplanet. Soc. 16, 508-17(1958) Sept.-Oct.

A recent paper [J.B.J.S. 15(1956)297] has derived an expression for the maximum overall specific impulse of an ion rocket. Since insufficient account was taken of the variables involved, this expression is incorrect; solutions that are valid for various design parameters are given in the present paper. Over-all specific impulse, however, is not in general a useful criterion in assessing the performance of a rocket, so relations replacing this by the characteristic velocity are presented. A special case of the exhaust velocity being variable with time is considered. It is further pointed out that the characteristic velocity of an ion rocket should not in general be made a maximum, and that instead such a rocket should be considered in terms of a particular transit, the transfer time being minimized. The solutions for the special case of a transit with fixed exhaust velocity or fixed acceleration in field-free space are given and are used to derive the characteristics of an ion rocket to which specific design and performance figures have been assigned. (auth)

2321

ELECTRIC FIELD GRADIENTS IN IONIC CRYSTALS. I. NUCLEAR QUADRUPOLE COUPLING CONSTANTS. Richard Bersohn (Cornell Univ., Ithaca, N. Y.). J. Chem. Phys. 29, 326-33(1958) Aug.

In ionic crystals and metals the coupling constant of a quadrupolar nucleus can often be written in the simplified form $eQ(\Delta E)(1-\gamma_\infty)$. The polarization factors $1-\gamma_\infty$ were calculated in previous work by T. P. Das, E. G. Wikner, and R. Bersohn. In the present work the factors ΔE are calculated in the form of lattice sums. Under favorable circumstances a good estimate of the nuclear quadrupole moment Q can be made. When Q is known by other means, information about the distribution of charges in crystals may be obtained. It is shown, for example, that Al_2O_3 is essentially ionic. The agreement between experimental and observed coupling constants proves that the field gradients in ionic crystals and metals is of long-range origin in contrast to molecular crystals. (auth)

2322

PARAMAGNETIC RESONANCE IN RARE EARTH TRICHLORIDES. Clyde A. Hutchison, Jr. and Eugene Wong (Univ. of Chicago). J. Chem. Phys. 29, 754-60 (1958) Oct.

Paramagnetic resonance absorption of all the naturally occurring rare earth trivalent ions in the $LaCl_3$ structure have been investigated. The results are summarized in the form of a tabulation of the parameters $g_{||}$, $g_\perp$, A, B, P, Δ in the spin-Hamiltonian. Theoretical calculations of crystal field states and eigenvalues as well as of $g_{||}$ and $g_\perp$, based on optical measurements, are discussed. (auth)

2323

SHOCK-TUBE STUDY OF LUMINOSITY IN XENON. Walter Roth and Per Gloersen (General Electric Research Lab., Schenectady, N. Y.). J. Chem. Phys. 29, 820-4(1958) Oct.

Shock waves in xenon producing temperatures in the range 6000 to 11,000°K have been found to result in emission of a visible continuum after an induction period. An activation energy for continuum emission has been found to correspond to the energy of the metastable state of the xenon atom. This energy can only be associated with visible continuum emission if ground state and metastable state atoms interact to form stable diatomic molecules in an excited state which subsequently make dissociative transitions to a repulsive ground state. (auth)

2324

GROUND-STATE INVERSION SPECTRUM OF $N^{14}D_3$. Gabriel Herrmann (New York Univ.). J. Chem. Phys. 29, 875-9(1958) Oct.

The inversion spectrum of $N^{14}D_3$ has been investigated between 1500 and 1620 mc/sec. A revised formula for the rotational fine structure was obtained to fit 17 observed lines. Splitting of K = 3 lines into two components was found in good agreement with predicted values. Nitrogen satellites were observed and the values $(eQq)_N = 4080 \pm 3$ kc/sec and $a = 2 \pm 2$ kc/sec were assigned to the nitrogen quadrupole and magnetic coupling constants, respectively. Hyperfine structure due to removal of the K degeneracy was observed in K = 1

lines. Applying the theory of Hadley, calculated and observed line contours were brought into agreement. Assuming cylindrical symmetry about bonds, the value $(eQq)_D = 200 \pm 20$ kc/sec was obtained for the deuteron quadrupole coupling constant. A value $\epsilon = 1.9 \pm 0.5$ kc/sec was obtained for the magnetic coupling constant between deuteron spins and molecular rotation. (auth)

2325

SUCTION OF THE BOUNDARY-LAYER FLOW ALONG A HOT PLATE AS A MEANS OF SEPARATING GAS MIXTURES. V. C. Liu (Univ. of Michigan, Ann Arbor). J. Chem. Phys. 29, 967-8(1958) Oct.

Gas separation during flow of a mixture along a hot plate is described. If the mixture consists of gases of unequal molecular weights, thermal diffusion is set up so that the lighter gas tends to move to the hot region and the heavier gas to the cold region. The light gas mixture can be enriched by suction through slots or a porous material near the hot surface. A summary of the diffusive separation in the boundary layer along the hot plate with surface suction is given. (J.R.D.)

2326

NUCLEAR MAGNETIC RESONANCE OF PROTON DILUTE SILICA GEL AND SILICA-ALUMINAS. D. E. O'Reilly (Gulf Research and Development Co., Harmarville, Penna.). J. Chem. Phys. 29, 970-1(1958) Oct.

Proton magnetic resonance absorption and dispersion mode signals were examined for silica-aluminas and silica gels dehydrated at 500°C in vacuum. The absorption derivatives have closely Lorentzian shape out to about eight times the half-width of the absorption where the signal-to-noise ratio approaches unity. Calibration of the integrated intensity of the absorption gave $6.0 \pm 1.2 \times 10^{20}$ and 1.8×10^{21} protons/g for silica-alumina and silica gel, respectively. The results of the investigation are discussed and compared with results of similar investigations by other workers. (J.R.D.)

2327

THE ^{18}O EFFECT ON THE INFRARED ABSORPTION OF TRIPHENYLPHOSPHINE OXIDE, AND THE STRUCTURE OF TRIPHENYLPHOSPHINE OXIDE HYDRATE. M. Halmann and S. Pinchas (Weizmann Inst. of Science, Rehovoth, Israel). J. Chem. Soc. 3264-7(1958) Oct.

The stretching vibration of the phosphoryl group in triphenylphosphine [O^{18}] oxide was compared with that of normal triphenylphosphine oxide. The frequency and intensity of the $P-O^{18}$ band are appreciably lower than those of the $P-O^{16}$ band. The results were used for determination of O^{18} content in triphenylphosphine oxide. The absence of oxygen exchange between triphenylphosphine oxide and water indicates that triphenylphosphine oxide hydrate does not have the dihydroxy-structure. (auth)

2328

ISOTOPE SHIFT IN THE ARC SPECTRUM OF ZINC. G. F. Hately and T. A. Littlefield (Univ. of Durham, Eng.). J. Opt. Soc. Am. 48, 851-3(1958) Nov.

The reflecting echelon interferometer has been used to determine isotope shift in eleven wavelengths in the zinc arc spectrum between λ2000 A and λ5000 A. Small quantities of enriched Zn-64, Zn-66, and Zn-68 isotopes were excited in Schüler type discharge tubes with liquid nitrogen cooling. In this way isotope shifts well below the resolving limit of the echelon have been investigated. The normal mass and volume effects have been calculated and subtracted from the observed isotope shift, the difference being attributed to the specific mass effect. For the resonance lines λ2139 A ($4s^2\ ^1S_0-4s4p\ ^1P_1$) and λ3076 A ($4s^2\ ^1S_0-4s4p\ ^3P_1$) the specific mass effect is larger than the normal mass effect and is in the same direction. The results confirm the work of Crawford, Gray, Kelly, and Schawlow. For the other wavelengths investigated, the specific mass effect is slightly smaller than the normal mass shift and is in the opposite direction. (auth)

2329

A SMOOTHEST CURVE APPROXIMATION. John C. Holladay (Los Alamos Scientific Lab., N. Mex.). Mathematical Tables and Other Aids to Computation 11, No. 60, 233-43(1957) Oct.

The problem of obtaining and examining an integration rule is examined, based on integrating a function passing through a given set of points such that the function will have a small amount of twisting and such that whatever twisting is necessary will be spread out. The problem solution is presented by development of theorems and proofs within the definitions given. (J.R.D.)

2330

SHIFTS OF ARC LINES AT VARIOUS PRESSURES IN MAGNETIC FIELDS. R. A. Miller (Manila Observatory, Baguio City, Philippines). Nature 182, 1295-6 (1958) Nov. 8.

An investigation of certain spectral lines emitted in a high-voltage arc between brass electrodes in nitrogen gas was made under pressures from 1/7 to 85 atmospheres. The arc was fun in and out of a magnetic field of 4,000 gauss. An empirical relation between the shift with and without a magnetic field at varied pressures for nine spectral lines was found. In all cases, the shift due to pressure in a magnetic field is less than in a non-magnetic field. Pressure shifts in spectral emission lines of zinc, copper, and lead in a magnetic field and in a non-magnetic field are shown graphically. (A.C.)

2331

CARBON-14 ACTIVITY DURING THE PAST 5,000 YEARS. K. O. Münnich (Univ. of Heidelberg, Ger.); H. G. Östlund (Geological Survey of Sweden, Stockholm); and Hl. de Vries (Rijks-Universiteit, Groningen, Netherlands). Nature 182, 1432-3(1958) Nov. 22.

Results from studies made by different laboratories on the variations of C^{14} activity during the past 5,000 years are discussed. (J.H.M.)

2332

EVIDENCE FOR $^6_2$He 'CLUSTERS' IN NUCLEI. L. H. Ahrens and R. D. Cherry (Univ. of Cape Town, South Africa). Nature 182, 1434-5(1958) Nov. 22.

A study of the neutron number, N, and atomic numbers, Z, of stable nuclei indicates: α-particle clusters appear to exist in the low-Z nuclei ($Z \leq 16$); most of the region Z 16 to Z 44 appears to be a transitional region where the cluster can be either He^4 or He^6; from Z 44 to 56, He^6 clusters appear to exist; it seems likely that "magic numbers" of protons or neutrons act as large clusters. (J.H.M.)

2333

RELATIVE SCINTILLATION EFFICIENCIES OF NOBLE GAS MIXTURES. J. A. Northrop and Judith C. Gursky (Los Alamos Scientific Lab., N. Mex.). Nuclear Instr. 3, 207-12(1958) Oct.

An investigation has been made of the relative amounts of scintillation light emitted from mixtures of the noble gases during the 0.5 μsec interval following

the stopping of an α-particle. A bellows pump and a hot uranium furnace in a closed circulation system maintained gas purity. A diphenyl stilbene coating on the photomultiplier tube and the walls of the scintillation volume acted as a wavelength shifter for the primary ultraviolet radiation. Data on the efficiency of various proportions of binary combinations of xenon, krypton, argon, neon, and helium are presented. They show a characteristic large drop in the light for mixtures containing a small proportion of the heavier gas in a major fraction of the lighter. These results may be qualitatively interpreted in terms of noble gas molecular ion formation. The large light output of the 10% Xe–90% He mixture might be useful in constructing a neutron spectrometer of high efficiency using the $He^3(n,p)H^3$ reaction. (auth)

2334

THE PREPARATION OF VERY THIN ELECTRIC-CONDUCTING FOILS FOR ABSOLUTE β COUNTING. E. Huster and W. Rausch (Univ. of Marburg, Ger.). Nuclear Instr. 3, 213–17(1958) Oct. (In German)

Absolute β-counting with radioelements of low decay-energy is difficult because of absorption losses in the source and its backing. If moreover the half-life is very high, extended sources are necessary. It has been furthermore shown, that backings must be electrically conducting to prevent charging of the source and thereby distortion of the electric field of the counter, if counting is done with the source in the interior of the counter. A method is described for preparing electrically conducting formvar foils of 85×30 mm^2 with an over-all thickness of 10 μg/cm^2. The conductivity is attained by first exposing the foil to a glow discharge in a hydrocarbon atmosphere and then evaporating silver on it. (auth)

2335

STUDIES OF NEUTRON PRODUCTION IN LINEAR DEUTERIUM PINCHES. P. Ohlin, K. Siegbahn, T. Sundström, and S. Svennerstedt (Inst. of Physics, Uppsala). Nuclear Instr. 3, 237–44(1958) Oct.

With the experimental set-up, described earlier, further studies of high current linear deuterium pinches have been made. The stabilizing effect of an external magnetic field has been investigated. This effect has appeared in two ways. Firstly, peaks in the voltage curves and dips in the current curves, which are interpreted as due to sausage instabilities, disappear at $B_z > 400$ gauss. Secondly, the number of subsequent pinches is increased by the field and as many as six consecutive pinches have been observed. The dependence of the neutron yield on the magnetic field has been found to be very weak, the yield decreasing only by a factor of 2/3 for 760 gauss. The influence of the gas pressure on the number of neutrons produced has been studied in the region 9 to 30 microns. For $B_z = 0$ a slight decrease in the neutron yield with increasing pressure has been observed. With the field applied the yield seems to be almost independent of the pressure. The resistance of the discharge has been found to decrease to 0.01 ohm within the first tenths of the discharge period. The results are discussed in connection with the results of other investigators. (auth)

2336

BREMSSTRAHLUNG FROM MULTIPLE SCATTERING. J. S. Bell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 8, 613–20(1958) Nov. (1).

It has been predicted, by largely classical arguments, that destructive interference of the radiation from many collisions greatly reduces the rate of energy loss by very high energy electrons undergoing multiple scattering. It is observed that this is incompatible with a standard formula in classical theory, and the discrepancy is traced to an inadequate account of the high-frequency part of the radiation spectrum. It is concluded that any real effect of this kind is of essentially quantal origin. (auth)

2337

THE RUNAWAY EFFECT IN A FULLY IONIZED PLASMA. E. R. Harrison (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 3, 1318–25(1958) Nov.

The conditions for producing runaway electrons in a fully ionized gas are considered, using Chandrasekhar's coefficient of dynamic friction. The runaway currents emitted continuously from linear plasmas are then estimated and are shown to be in agreement within an order of magnitude with the results from some preliminary experimental work. The rate of increase of runaway currents in closed circuits, such as toroidal plasmas, is estimated and is found to be proportional to t^2 (t = time). From some recently published results with toroidal plasmas it is shown that the runaway current, provided it is contained and is not drastically affected by the magnetic fields, can rapidly become comparable in value with the conduction current. In the experimental work with linear plasmas, x rays were observed having an energy greater than the applied potential difference to the apparatus. (auth)

2338

CRITERIA FOR THERMODYNAMIC EQUILIBRIUM IN GAS FLOW. Morton Rudin (Lockheed Aircraft Corp., Palo Alto, Calif.). Phys. Fluids 1, 384–92(1958) Sept.-Oct.

When gases flow at high velocity, the rates of internal processes may not be fast enough to maintain thermodynamic equilibrium. By defining quasi-equilibrium in flow as the condition in which the temperature, pressure, density, and velocity deviate by less than a fixed, small percentage from what they would be if the flowing gas could actually be in thermodynamic equilibrium, criteria are derived for determining whether quasi-equilibrium is a stable condition in the flow. By use of excitation of molecular vibration as an example, the general properties of criteria curves are discussed and interpreted. A discussion is given of how to use these results to determine definitely whether a flow is or is not in thermodynamic equilibrium. Applications to dissociating gases, to mixtures, and to the phenomenon of "choking" in a Laval nozzle are given special consideration. For cases when application of the criteria predict nonequilibrium, equations are provided in a form useful for numerical forward integration along streamlines. (auth)

2339

PRECISION FLASH X-RAY DETERMINATION OF DENSITY RATIO IN GASEOUS DETONATIONS. Russell E. Duff, Herbert T. Knight, and John P. Rink (Los Alamos Scientific Lab., New Mex.). Phys. Fluids 1, 393–8(1958) Sept.-Oct.

An x-ray densitometer has been used to measure the density ratio across a detonation wave in a number of different gaseous mixtures involving C_2H_2, C_2N_2, or H_2 with O_2 and Kr. In a 3-in. i.d. tube at an initial pressure

of 60 cm the density ratios observed were between 1.64 and 1.67. Investigations of the influence on density ratio of tube diameter at constant initial pressure and of initial pressure at constant tube diameter both indicate an extrapolated infinite diameter density ratio of 1.70 for a 0.3 C_2H_2 + 0.3 O_2 + 0.4 Kr mixture. This result is significantly lower than the ratio 1.79 which corresponds to the tangent point on the equilibrium Hugoniot from the initial state. At the present time these observations cannot adequately be explained by detonation theory. (auth)

2340

TRANSITION FROM SLOW BURNING TO DETONATION IN GASEOUS EXPLOSIVES. Frederick J. Martin (General Electric Research Lab., Schenectady, N. Y.). Phys. Fluids 1, 399-407(1958) Sept.-Oct.

High-speed photographic observations have been made of flame structure, flame velocity, and shock velocity during the transition from slow burning to detonation in acetylene-oxygen mixtures contained in glass pipe at reduced pressures. During intermediate stages the dome-shaped flame travels down the tube at about 800 m/sec and is preceded by a shock wave traveling slightly faster. During the final stages of formation of the detonation wave, the flame changes shape, accelerates, and advances along the walls in an asymmetric manner. The detonation first appears at, or slightly behind, the leading edge of the flame. The final flame acceleration occurs when the Reynolds number of the mass flow between the flame and the preceding shock, based upon the distance traveled by a mass element in the time interval between passage of the shock and the flame through it, is about 10^7. Under these conditions the development of turbulent regions in the boundary-layer flow ahead of flame appears likely. Changes in flame configuration which result in the final acceleration and the formation of the detonation wave then arise from the faster flame propagation into these turbulent areas than into the free-stream region. (auth)

2341

PLASMA HEATING OF SUPERSONIC AIRSTREAM. Raymond L. Chuan (Univ. of Southern California, Los Angeles). Phys. Fluids 1, 452(1958) Sept.-Oct.

A small experimental apparatus was designed to ascertain the feasibility of using the decay of an r-f discharge-formed plasma to transfer energy to a supersonic air stream. (J.E.D.)

2342

SOME EXAMPLES OF TURBULENT DIFFUSION IN LIQUID METALS. A. Paoletti and M. Vicentini (Univ. of Rome). Phys. Fluids 1, 453-4(1958) Sept.-Oct.

2343

SOME OBSERVATIONS ON THE DECAY OF IODINE-124 AND THEIR IMPLICATIONS IN RADIOIODINE THERAPY. N. A. Dyson and P. E. Francois (Hammersmith Hospital, London). Phys. in Med. and Biol. 3, 111-22(1958) Oct.

Observations on the decay of iodine-124 are described, and some modifications to the published decay scheme are suggested. The implications of these changes are discussed with particular reference to the use of radio-iodine in the treatment of thyroid cancer. (auth)

2344

THERMAL CONDUCTIVITY OF AN ELECTRON GAS IN A GASEOUS PLASMA. T. Sekiguchi and R. C. Herndon (Univ. of Illinois, Urbana). Phys. Rev. 112, 1-10(1958) Oct. 1.

The thermal conductivity of an electron gas in a gaseous plasma is determined by experimental techniques which have been improved over those reported in a previous article by Goldstein and Sekiguchi. A pulsed microwave is utilized to probe the plasma parameters as well as to selectively heat up the electron gas in a small volume of the elongated plasma. The photomultiplier tube detects the change in electron temperature by taking advantage of the phenomenon of "afterglow quenching." The experimental values for the thermal conductivity, which are determined by two different methods, are in good agreement. In the plasmas investigated, neon and helium, the degree of ionization is very low (10^{-5}–10^{-6}). However, the measured values of the thermal conductivity are still consistent with those obtained from the theoretical expression given by Landshoff, or Spitzer and Härm for a fully ionized gas. (auth)

2345

EXCITATION OF ROTONS IN HELIUM II BY COLD NEUTRONS. H. Palevsky, K. Otnes, and K. E. Larsson (A.B. Atomenergi, Stockholm). Phys. Rev. 112, 11-18(1958) Oct. 1.

The nature of collective excitations in helium II has been investigated by means of the interaction of these excitations with cold neutrons. The experiment demonstrates the existence of excitations with long mean free path compared to their wavelength, confirming the theoretical ideas of Landau and Feynman. The dispersion relation for the excitations in the energy region of the "roton minimum" is directly measured and gives the following Landau parameters: $\Delta = 8.1 \pm 0.4°K$, $P_0/\hbar = 1.9 \pm 0.03\ A^{-1}$ and $\mu = 0.16 \pm 0.02 m_{He}$. (auth)

2346

TEMPERATURE EFFECT ON POSITRON ANNIHILATION IN CONDENSED MATTER. R. L. de Zafra and W. T. Joyner (Univ. of Maryland, College Park). Phys. Rev. 112, 19-29(1958) Oct. 1.

An experimental investigation has been made of the temperature effect on the angular distribution of radiation from positron annihilation in matter. The materials chosen were Teflon, fused quartz, naphthalene, and water, for which the most comprehensive studies of the long-lifetime (τ_2) component and its intensity under various conditions have previously been made. The correlation between τ_2 lifetime and intensity and the amount of narrow component in the angular distribution has been studied both in a single phase, and as a function of phase change. Evidence seems conclusive that the so-called temperature effect on angular distributions is in reality a density effect. The underlying cause of the narrow-component enhancement seems in part to be related simply to an increase in positronium production which follows density changes. In quartz, and in water, Teflon, and naphthalene within the present limits of error, the enhancement may be attributed to this cause alone. The narrow component in quartz, Teflon, and naphthalene is found to have a width corresponding to a center-of-mass energy at the time of annihilation of about 10 times the thermal energy for positronium. The water-ice transition shows extremely interesting properties, marked by the appearance of a very narrow and well defined peak in the ice phase. It is suggested this is due to a reduction of the zero-point energy caused by enlargement of cavities in which

positronium is trapped. Some anomalies are pointed out in the existing τ_2 intensity, lifetime, and 3γ annihilation rate as a function of phase change in water. (auth)

2347

MEASUREMENT OF ATOMIC AND MOLECULAR EXCITATION BY A TRAPPED-ELECTRON METHOD. G. J. Schulz (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 112, 150-4(1958) Oct. 1.

A trapped-electron method is used to study inelastic processes in helium, mercury, and hydrogen. In this method, an electron beam traverses an electric and magnetic field configuration in which the low-energy electrons resulting from inelastic collisions are prevented from reaching the electron beam collector by a potential well. The low-energy electrons can reach a cylindrical collector surrounding the electron beam. The collection efficiency appears to be close to unity for electrons in the range 0 to 0.1 electron volt and zero at higher energies. The design of the tube and applied potentials determine the range of collection. A complete spectrum of energy levels is obtained in He, Hg, H_2, within the resolution of the instrument (better than 0.2 ev). The experiment yields approximate slopes of the resolved excitation functions near threshold. The method is well suited for a study of excitation events in molecules. (auth)

2348

DISSOCIATION OF THE HYDROGEN MOLECULE ION BY ELECTRON IMPACT. Eugene V. Ivash (Univ. of Texas, Austin). Phys. Rev. 112, 155-8(1958) Oct. 1.

The dissociation cross section of H_2^+ for bombardment by electrons is investigated taking into account the effect of exchange collisions by use of the Born-Oppenheimer approximation. Both the post and prior interactions are considered. Theoretical results are presented for the transition in which the molecule ion is raised from the ground state $1s\sigma^2\Sigma_g^+$ to the lowest-lying repulsive state $2p\sigma^2\Sigma_u^+$ and then dissociates. The Franck-Condon principle is assumed throughout, and a classical average is taken over the molecular orientations. Numerical results are given for the dissociation cross sections as a function of energy both with and without the inclusion of exchange effect. The agreement between the post- and prior-interaction cross sections near the threshold energy is poor. (auth)

2349

MAGNETICALLY CONFINED PLASMAS. A. C. Kolb (U. S. Naval Research Lab., Washington). Phys. Rev. 112, 291-6(1958) Oct. 15.

The propagation of high-velocity shock waves in an axial magnetic field generated by single-turn coils connected in parallel to a condenser bank is investigated. Time-resolved photographs show that the plasma behind the shock front is driven away from the tube walls by the magnetic pressure. This compression heats the ionized gas and maintains a high shock velocity during the transit of the front through the coil. The compressed plasma appears to be stable and undergoes radial oscillations that follow the current oscillations. The interpretation and significance of these observations in controlled thermonuclear fusion research are discussed. (auth)

2350

ABSORPTION SPECTRUM OF KCl:Tl AT LOW TEMPERATURES. David A. Patterson (U. S. Naval Research Lab., Washington). Phys. Rev. 112, 296-7(1958) Oct. 15.

The ultraviolet absorption spectrum of thallium in single-crystal potassium chloride has been accurately measured down to 187 mμ at 295°, 77°, and 4°K. The asymmetry apparent in both major bands at room temperature disappears at low temperature. The existence of two kinds of singlet thallium centers in slightly different crystalline environments is suggested as a possible explanation. (auth)

2351

TEMPERATURE DEPENDENCE OF THE CHARACTERISTIC ENERGY LOSS OF ELECTRONS IN ALUMINUM. Lewis B. Leder and L. Marton (National Bureau of Standards, Washington). Phys. Rev. 112, 341-3(1958) Oct. 15.

The change in the 15-ev characteristic energy loss suffered by 15-kev electrons passing through a thin film of aluminum has been measured as a function of temperature from 4.2°K to 518°K. It is found that above room temperature the energy loss change agrees, within experimental error, with the change expected due to decreased electron density resulting from expansion of the lattice. However, below room temperature the energy loss change is much greater than expected on the above basis. It was also found that the half-widths of both the energy loss and the zero loss lines increased with decreasing temperature while the ratio of these two remained constant. (auth)

2352

INTERACTION ENERGY AND MOBILITY OF Li^+ IONS IN HELIUM. E. A. Mason, H. W. Schamp, Jr., and J. T. Vanderslice (Univ. of Maryland, College Park). Phys. Rev. 112, 445-8(1958) Oct. 15.

The interaction energy of Li^+ and He has been calculated for a range of internuclear separations. The results are not in very good agreement with a similar calculation by Meyerott, who used the same wave functions but approximated many of the molecular integrals. Considerable uncertainty is caused by lack of knowledge of the second-order exchange energy. The results are used to calculate the mobility of Li^+ ions in He gas as a function of temperature for comparison with experiment. It is concluded that the theoretical interaction energy is not inconsistent with the experimental mobility data, within the uncertainty caused by the second-order exchange energy. (auth)

2353

FREQUENCY SHIFT OF THE ZERO-FIELD HYPERFINE SPLITTING OF Cs^{133} PRODUCED BY VARIOUS BUFFER GASES. M. Arditi (Federal Telecommunication Labs., Nutley, N. J.) and T. R. Carver (Princeton Univ., N. J.). Phys. Rev. 112, 449(1958) Oct. 15.

The pressure shift, caused by collisions with various noble gases in the zero-field ground-state hyperfine interaction of Cs^{133}, has been measured by an optical transmission, microwave saturation method. A pressure shift to higher frequency was found in the case of the lighter gases, hydrogen, helium, nitrogen, and neon (+1900, +1600, +930, +650 cps/mm Hg) while a pressure shift to lower frequency was found in the case of the heavier gases, argon, krypton, and xenon (−250, −1300, −2400 cps/mm Hg). (auth)

2354

NARROW HYPERFINE ABSORPTION LINES OF Cs^{133} IN VARIOUS BUFFER GASES. E. C. Beaty and P. L. Bender (National Bureau of Standards, Washington),

and A. R. Chi (U. S. Naval Research Lab., Washington). Phys. Rev. 112, 450-1(1958) Oct. 15.

Line widths as narrow as 40 cps have been obtained for the hyperfine transition at 9192 Mc/sec in cesium vapor. The Doppler width was greatly reduced by collisions with an inert buffer gas. An optical detection method was used to observe the microwave absorption lines. Shifts in the observed frequency due to collisions with the buffer gas were measured as a function of the temperature and pressure of the gas. It was found possible to reduce greatly the shift in frequency with temperature by using the proper mixtures of inert gases. The contribution to line width due to collisions with the buffer gas was also determined. (auth)

2355

INNER BETA SPECTRA OF Ag^{111} AND Rb^{86}. R. L. Robinson and L. M. Langer (Indiana Univ., Bloomington). Phys. Rev. 112, 481-5(1958) Oct. 15.

The relatively high comparative half lives of the low-energy, inner beta-ray group of Ag^{111} and the inner group of Rb^{86} suggest that their spectra may have nonstatistical shapes. The spectra were investigated with a 4π beta-ray scintillation spectrometer which had been adapted for beta-gamma coincidence studies. Both spectra are found to exhibit nonstatistical shapes. (auth)

2356

SOME MEASUREMENTS OF ATMOSPHERIC NEUTRONS. John D. Gabbe (New York Univ.). Phys. Rev. 112, 497-502(1958) Oct. 15.

A series of airplane flights carrying neutron counters to an altitude of 700 g cm^{-2} was made at 52°20′ north geomagnetic latitude in 1955. Enriched and normal BF_3 counters were covered with Cd, Sn, Pyrex, and lime-glass shields. The ratios of the counting rates of the variously shielded counters are compared with the ratios calculated theoretically on a thick-shield basis using the neutron energy distribution function derived by Freese and Meyer. The neutron-production data taken by Davis and by Staker and Pyrex-glass-envelope BF_3 counters are corrected for the absorption of neutrons by the boron in the Pyrex. The corrected neutron-production rates are recalculated to be 2.1 ± 0.4 cm^{-2} sec^{-1} and 0.9 ± 0.2 cm^{-2} sec^{-1} at 54°36′ and 30°24′ north geomagnetic latitude, respectively, using recent values for the various neutron cross sections. These corrected rates agree, to within 5%, with the recent measurements reported by Soberman. The above energy distribution function was found, within the limited accuracy of the experiment, to describe the energy distribution of atmospheric neutrons. (auth)

2357

INTERPLANETARY MAGNETIC FIELD AND ITS CONTROL OF COSMIC-RAY VARIATIONS. J. H. Piddington (Commonwealth Scientific and Industrial Research Organization, Sydney). Phys. Rev. 112, 589-96(1958) Oct. 15.

A model interplanetary magnetic field is described which may explain some features of solar cosmic-ray increases and also fluctuations in the primary radiation. A chromospheric "explosion" occurs at the time of a flare in gas permeated by the sunspot field. The gas, linked with magnetic flux $\lesssim 10^{21}$ gauss cm^2, is ejected from the vicinity of the sun. The gas and field remain linked and the latter is so distorted that solar cosmic-rays are released $\sim 1/4 - 1$ hour after the flare. The trailing radial field is drawn out past the earth's orbit to form a magnetic cone with closed ends. The life of the interplanetary field is at least a few months and a number of segments may built up from different spot fields. The general field may contribute, being extended to largely radial form by a general outward movement of gas. Cosmic rays released after one flare may be influenced by the radial field resulting from a previous flare associated with the same, or perhaps a different, spot group. February 23, 1956, the magnetic cone enclosing the earth contained irregularities separated by ~0.5 astronomical unit, capable of deflecting 15-Bev protons up to ~20° and completely scattering 1.5-Bev protons. Cosmic-ray diffusion was anisotropic, the rate being ~65 times greater along the field than across the field. The main features of the solar increase may be explained by such a field. Some observed variations of primary cosmic radiation (Forbush-type decreases, 27-day and diurnal variations) may be qualitatively explained by the model. The model may explain auroras in terms of ions of intermediate energy ($\sim 10^8$ ev) transported from the sun in the magnetic cone which reaches the earth in a day or two and may inclose it for many days or weeks. (auth)

2358

DETERMINATION OF THE HYPERFINE STRUCTURE OF ATOMIC NITROGEN BY OPTICAL ORIENTATION. W. W. Holloway, Jr. and R. Novick (Univ. of Illinois, Urbana). Phys. Rev. Letters 1, 367-8(1958) Nov. 15.

In the method of optical orientation with spin exchange the problems of dissociation of molecular nitrogen and detecting nitrogen atoms are simply and effectively solved: fractional dissociation of only about one part in 10^7 is required, and detection is effected with a photocell. New precise values for the hyperfine intervals of the ground state of atomic nitrogen are reported. The experiment is performed in a 500 cc flask filled with N_2 at a pressure of 3.0 cm Hg, He at 0.5 Hg, and Rb vapor at a temperature of 50°C. Nitrogen atoms are produced by a pulsed discharge between aluminum electrodes mounted along a diameter of the bulb. (W.D.M.)

2359

NUCLEAR ORIENTATION AND NUCLEAR COOLING. Nicholas Kurti. Phys. Today 11, No. 3, 19-25(1958) Mar.

A general survey of experiments with oriented nuclear systems produced by cyrogenic methods is presented. The expression "oriented nuclei" is generally used to denote a system whose nuclear spins instead of pointing at random are preferentially oriented along one or several particular directions. Nuclear orientation is defined by $[R \ln (2I + 1) - S]/[R \ln (2I + 1)]$ not $\ll 1$, where I is the nuclear spin and R the gas constant. The purely cyrogenic application of oriented nuclei to nuclear cooling is discussed. (W.D.M.)

2360

A LAGRANGIAN FORMULATION OF THE BOLTZMANN-VLASOV EQUATION FOR PLASMAS. F. E. Low (Los Alamos Scientific Lab., N. Mex.). Proc. Roy. Soc. (London) A248, 282-7(1958) Nov. 11.

A variational principle is found for the Boltzmann–Vlasov equation for an ionized gas in an electromagnetic field. The principle leads to a new formulation of the problem of small oscillations about equilibrium. (auth)

2361

IONIZATION POTENTIALS AND LAMB SHIFTS OF THE GROUND STATES OF ^4He AND ^3He. G. Herzberg

(National Research Council, Ottawa). Proc. Roy. Soc. (London) A248, 309-32(1958) Nov. 25.

In order to obtain an experimental value for the Lamb shift of the ground state of helium, it is necessary to determine a very precise value for the ionization potential. For this purpose the wavelengths of the far ultra-violet lines 584.3 (1^1S-2^1P), 537.0 (1^1S-3^1P), and 591.4A ($1^1S-2^3P_1$) of He^4 have been redetermined with much improved accuracy and those of He^3 have been measured for the first time. The standards used were lines of C^+ and A^+ in the region 610 to 520A which were derived by means of the combination principle from lines at longer wavelengths. The final results for the wavelengths of the He^4 lines are 584.3339, 537.0293, and 591.4121A with an estimated accuracy of ±0.0005A. For He^3 the corresponding figures, obtained by adding the measured shifts to the He^4 wavelengths, are 584.3640, 537.0577, and 591.4466A. The term values of the upper states of these lines relative to the ionization limit have been redetermined by a new measurement of the Bergman series 3^3D-n^3F, of the intercombination lines 2^3P-3^1D and 2^1P-3^3D and a remeasurement of the near ultra-violet 2^1P-n^1D and 2^3P-n^3D series. Combining these results with those of the far ultra-violet lines the following values for the ionization potentials of He^4 and He^3 are obtained: I.P.(He^4) = $198310.8_2 \pm 0.15$ cm^{-1}, I.P.(He^3) = $198300.3_2 \pm 0.15$ cm^{-1}. The isotope shift of the ground state, 10.50 ± 0.05 cm^{-1}, agrees closely with the theoretical prediction. Experimental values for the Lamb shift are obtained by comparing the observed ionization potentials with those obtained from the Dirac theory not including quantum electrodynamic effects. Using Kinoshita's 39-parameter value, one finds a Lamb shift of -0.7_9 and $-0.8_2 \pm 0.15$ cm^{-1} for He^4 and He^3, respectively. [Added in proof: Using Pekeris's 203-parameter value one finds -1.1_9 and -1.2_3 cm^{-1}, respectively.] The value predicted by Kabir, Salpeter & Sucher is $-1.3_3 \pm 0.2$ cm^{-1}. (auth)

2362

ENERGY PER ION PAIR FOR ELECTRON AND PROTON BEAMS IN ATOMIC HYDROGEN. A. Dalgarno (Queen's Univ. of Belfast) and G. W. Griffing (Phillips Petroleum Co., Idaho Falls, Idaho). Proc. Roy. Soc. (London) A248, 415-28(1958) Nov. 25.

The angular distribution of electrons of given energy ejected by ionization of atomic hydrogen is calculated according to the Born approximation and used in conjunction with similar calculations by Bates, Dalgarno, and Griffing of the cross sections of other processes involving protons and atomic hydrogen to compute a mean specific energy per ion pair in a gas of atomic hydrogen for a beam consisting of protons and neutral hydrogen atoms in charge equilibrium, a range of beam energies from 10 kev to 3 Mev being covered. In contrast to previous theories, capture and loss are taken explicitly into account and it is shown that they cause a considerable extension of the range over which the mean specific energy is nearly constant. The mean specific energy per ion pair is also calculated as a function to impact energy for an electron beam with energies up to 1 kev. The results are in harmony with experimental data if the assumption is made that (at high energies) a hydrogen molecule is equivalent to two hydrogen atoms. (auth)

2363

ELECTRON-BOMBARDMENT DETECTION OF NONCONDENSABLE MOLECULAR BEAMS. W. E. Quinn, A. Pery, et al. (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr. 29, 935-43(1958) Nov.

An electron-bombardment detector developed for the detection of noncondensable as well as condensable molecular beams is described. The ionization efficiency for a hydrogen deuteride beam is in the range of 10^{-5} to 10^{-4}. Auxiliary components include: vacuum buffer chambers for source background gas reduction; a mass spectrometer for ion mass selection; an electron multiplier, electrometer, and phase-sensitive detector combination for signal observation. Modulation techniques for beam and magnetic resonance detection are discussed. Efficiencies, background problems, and relevant noise sources are included in a discussion of operational characteristics. A resonance line trace produced by at most 3% of a total HD beam is presented to demonstrate the signal to noise ratio at low signal levels. The system has effectively detected beams of permanent gases such as HD, D_2, and Ne. (auth)

2364

GAS CIRCULATING APPARATUS CONTAINING A MAGNETIC BALANCE. L. C. Scala, W. M. Hickam, and A. Langer (Westinghouse Research Labs., Pittsburgh). Rev. Sci. Instr. 29, 988-90(1958) Nov.

A gas circulating system is described in which a sample undergoing thermal decomposition can be weighed continuously by means of a magnetic balance having a sensitivity of the order of 0.1 mg. Changes of composition in the gases contained in the system are determined by withdrawing samples directly into a mass spectrometer for analysis. Accurate quantitative measurements of the uptake and evolution of gases during the degradation process are thus obtained, providing an insight into the reactions that occur. This simple system should prove useful in many other fields of investigation. (auth)

2365

DENSITY OF BASIC ROCKS AT VERY HIGH PRESSURES. Darrell S. Hughes and Robert G. McQueen. Trans. Am. Geophys. Union 39, 959-65(1958) Oct.

The densities of two gabbros and one dunite have been measured at several pressures in the range from 150 to 750 kilobars (1 kilobar = 986.9 atmospheres). These pressures were attained in shock fronts generated by high explosives. The densities were computed from the observed shock waves. The dunite, initial density of 3.25 g/cc, was compressed to a density of about 4.9 g/cc at 720 kilobars. The gabbros, initial density 3.0 g/cc, were compressed to 5.0 g/cc at 750 kilobars. Both gabbros show evidence of a polymorphic transition at some pressure around 150 kilobars to a m re dense, but less compressible phase. The agreement obtained from these data with a crust of dunite 400 kilometers thick underlain by a gabbroic rock with Bullen's Model A is very close. (auth)

2366

COSMIC RAY PROGRAM: FIRST TWELVE MONTHS. Scott E. Forbush (Carnegie Inst. of Washington). Trans. Am. Geophys. Union 39, 1004-10(1958) Oct.

A summary of the results of cosmic-ray studies in the IGY program is briefly presented. (J.E.D.)

2367

ABSORPTION OF Co^{60} γ EMISSION IN CADMIUM SULFIDE. I. D. Konozenko, V. I. Ust'yanov, and V. P. Kedrov (Inst. of Physics, Kiev). Zhur. Tekh. Fiz. 28, 1397-1401(1958) July. (In Russian)

The linear coefficient of compressed powdered CdS sulfide absorption was determined with respect to the compression forces. It is shown that at a compression above 10^4 kg/cm^2 the coefficient remains constant and equal to 0.184 cm^{-1}, which is close to theoretical. The linear coefficient of compressed (P = 11,300 kg/cm^2) crystalline CdS is equal to 0.189 cm^{-1}. The mass coefficient measured directly (0.042 cm^2/g) and the total mass coefficient of the components (0.047 cm^2/g) are in a good agreement. The mean path of the Co^{60} γ quanta in CdS is 5.3 cm, and the half-thickness of CdS for the quanta of this energy is 3.6 cm. (R.V.J.)

2368

DIELECTRIC POLARIZATION AND LOSSES OF SOME COMPLEX COMPOUNDS. G. A. Smolenskii and A. I. Agranovskaya (Inst. of Semi Conductors, Leningrad). Zhur. Tekh. Fiz. 28, 1491-3(1958) July. (In Russian)

The mechanisms of dielectric polarization in Pb_3MgNb_2O and $Pb_3NiNb_2O_9$ and a series of lanthanites were investigated. (R.V.J.)

2369

THE EFFECTS OF MULTIPLE SCATTERING ON THE ATTENUATION OF γ RADIATION IN EXTENDED SOURCES. E. E. Kovalev and D. P. Osanov (Moscow Inst. of Engineering Physics). Zhur. Tekh. Fiz. 28, 1610-12(1958) July. (In Russian)

A method is offered for calculations of the multiple scattering in the shield and source of extended sources whose analytical formulas for the yield and attenuation of γ radiation (truncated cone, disk, etc.) are known. (R.V.J.)

2370

LEHRBUCH DER KERNPHYSIK. BAND I. EXPERIMENTELLE VERFAHREN. (Textbook of Nuclear Physics. I. Experimental Methods.) G. Hertz. Leipzig, B. G. Teubner Verlagsgesellschaft, 1958. 228p.

The experimental methods of nuclear physics, especially the measuring methods including mass spectroscopy and the installations for production of high-energy particles, are presented. The topics discussed are methods for the determination of the fundamental quantities of the atomic nuclei, detection of energetic radiation, and particle accelerators. (J.S.R.)

2371

ARTIFICIAL SATELLITES. Second Revised and Extended Edition. A. Shternfel'd. Moscow, State Publishing House for Technical and Theoretical Literature, 1958. A translation prepared by Wright-Patterson Air Force Base, Ohio. 433p. $6.00(OTS).

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 15624.

Elementary Particles

2372 AFOSR-TN-58-921

Purdue Univ., Lafayette, Ind.

DECAY OF HYPERONS AND MESONS FROM THE UNIVERSAL FERMI INTERACTION. Akihiko Fujii and Masaaki Kawaguchi. [1958]. 23p. Contract AF18(600)-1579. (AD-204559).

The decay of the hyperon, charged pion and kaon except $K^+_{\pi_2}$ is investigated on the basis of the universal V-A Fermi interaction together with the idea of the Gell-Mann tetrahedron, by treating the virtual baryon-antibaryon pair effect in a phenomenological way. It is shown that the decay rate of $K^+_{\pi_3}$ calculated by the parameters adjusted to the decay of π^+, $K^+_{\mu_2}$, and $K^+_{e_3}$ is in agreement with experiment, thus suggesting a possible consistent picture of the model. (auth)

2373 NP-7021

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.

π-e DECAY AND THE UNIVERSAL FERMI INTERACTION. Colber G. Oliveira and J. Tiomno. May 19, 1958. 14p. (Notes de Fisica Vol. IV, No. 5).

The possibility is examined that the contribution of hyperons to the intermediate states may cancel significantly that of nucleons, to an extent that both $\pi \rightarrow \mu$ and $\pi \rightarrow e$ probability resulting from the intermediate baryon-pair, becomes smaller than the experimental values, thus allowing for a direct $\pi \rightarrow \mu$ interaction, without a direct $\pi \rightarrow e$ interaction, which would be consistent with the experimental results. (W.D.M.)

2374

SHOWER PRODUCTION AT SMALL THICKNESSES OF ABSORBER. L. Nagy (Central Research Inst. for Physics, Budapest). Acta Phys. Acad. Sci. Hung. 9, 63-72(1958).

The shape of the first part of the Rossi curve was investigated in the case of Al, Fe, Cu, and Pb absorbers separating showers generated by mesons, electrons, and photons. (auth)

2375

DETERMINATION OF THE RATIOS BETWEEN THE NUMBER OF PHOTONS AND THE NUMBER OF ELECTRONS IN EXTENSIVE AIR SHOWERS OF COSMIC RADIATION BY MEANS OF A WILSON CHAMBER. I. Dohan, T. Gemesy, T. Sandor, and A. Somogyi (Ungarischen Akademie der Wissenschaften, Budapest). Acta Phys. Acad. Sci. Hung. 9, 97-103(1958). (In German)

In a Wilson cloud chamber with an effective cross section of 300 cm^2, seven lead plates of 33 mm thickness were placed. The chamber was regulated by an apparatus for extensive air showers, and the numbers of primary electrons and electron pairs were counted. After a correction for the number of penetrating photons, the ratio of the number of photons to the number of electrons in the extensive air showers was calculated as 1.16 ± 0.04. (tr-auth)

2376

DISINTEGRATION OF THE K MESON. Luis María Garrido Arilla (Univ. of Madrid). Anales real soc. espãn. fis. y quím. (Madrid) Ser. A 54, 199-233(1958) July-Aug. (In Spanish)

By means of quantum field theory, in its covariant relativistic formulation, a model is presented for the decay mechanism of K mesons in agreement with experimental data. The properties of K mesons are studied and many of their intrinsic quantum numbers and their invariance properties are determined. It is concluded that a new space—the intrinsic parity—must be introduced in order to have sufficient degrees of freedom. To the lagrangian a decay term is added and, certain strength for the coupling constants, a strength suggested by the production and decay processes is assumed. The total decay probabilities are evaluated, and the following values for these constants are obtained: $g^2/4\pi \sim 1/25$ and $\lambda \sim 5 \times 10^{-7}$ in agreement with the postulates. There seems to exist a coupling whose

strength is intermediate between the electromagnetic and the nuclear force couplings. (auth)

2377

A THEORY OF PARTICLES OF SPIN ONE-HALF. A. O. Barut (Syracuse Univ., N. Y.). Ann. Phys. (N.Y.) 5, 95-105(1958) Oct.

From the two-component second order fermion theory of Feynman and Gell-Mann a four component theory of spin-½ particles in Hamiltonian form is derived. When a suitable indefinite metric is introduced in the spin space by means of charge density the spin as well as the charge degrees of freedom may be separated. Spin and angular momentum are separately constants of the motion which is not the case for the Dirac equation. If states with positive norm describe particles the states of the corresponding charge conjugate particles have negative norm. The Hamiltonian is quadratic in the momenta which allows a straightforward transition to the nonrelativistic Pauli equation. The law of transformation of the wave function under the Lorentz transformations is given, and the relation and equivalence of the theory to Dirac and Foldy-Wouthuysen equations are established. (auth)

2378

LONG-LIVED NEUTAL K MESONS. M. Bardon, K. Lande, and L. M. Lederman (Columbia Univ., N. Y. and Brookhaven National Labs., Upton, N. Y.). Ann. Phys. (N.Y.) 5, 156-81(1958) Oct.

The results of a complete analysis of photographs obtained by the Columbia 36-in. magnet cloud chamber in neutral beams of the Brookhaven Cosmotron are presented. A "short-distance" exposure yielded 152 events giving unambiguous proof of the existence of long-lived neutral V-particles, most naturally interpreted as examples of K_2^0 disintegrations. In a subsequent "long-distance" run, 34 events were found, giving a lifetime for K_2^0 of $8.1^{+3.2}_{-2.4} \times 10^{-8}$ sec. Decay modes identified were: $\pi^{\pm}e^{\pm}$ plus a neutral; $\pi^{\pm}\mu^{\pm}$ plus a neutral and $\pi^+\pi^-$ plus a neutral. These are most economically interpreted as the neutral counterparts of K^+ decay, i.e., $\pi^{\pm}e^{\pm}\nu$, $\pi^{\pm}\mu^{\pm}\nu$, and $\pi^+\pi^-\pi^0$. In this case, the first two constitute the bulk of the events, the τ^0 mode being ≃15% of the total sample. No evidence is found for 2-body disintegrations. Finally, the recent literature on the subject of K_2^0 is briefly reviewed. (auth)

2379

COSMIC RAY ORBITS IN INTERPLANETARY MAGNETIC FIELDS. Lars Block. Arkiv Fysik 14, 161-78 (1958).

An interplanetary magnetic field, which should agree with observed cosmic ray and magnetic storm effects, has been suggested by Alfvén. This field is worked out more in detail in the present paper, and several cosmic ray orbits are calculated in this field. The results are briefly discussed and compared with cosmic ray observations. A beam field of 30 μ gauss at the earth's orbit has been assumed here, and according to Venkatesan's analysis of Forbush decreases the beam fields may vary from a few to about 100 μ gauss. (auth)

2380

ON THE INTERPLANETARY GAS AND ITS MAGNETIC FIELD. Lars Block. Arkiv Fysik 14, 179-93(1958).

Previously two different models of the interplanetary magnetic field have been proposed by Lüst and Schlüter, and by Alfvén. Lüst and Schlüter have only considered the interaction with the interplanetary gas, whereas Alfvén only considers cosmic ray and magnetic storm data. This paper critically examines both fields and a suggestion for a compromise between the two is made, so that all known physical phenomena of importance are considered. It is also shown that there are three independent arguments why the interplanetary gas density at the earth's orbit cannot be higher than about 0.1 cm^{-3}, viz., cosmic ray data indicate that the gas co-rotates with the sun at the earth's orbit, and no magnetic field is able to maintain this if the density is higher, beams denser than about 25 cm^{-3} should be seen in the corona according to Alfvén, beams of a density of about 0.1 cm^{-3} seem to suffice for the production of moderate magnetic storms if the electric field theory is correct. (auth)

2381

INTERACTIONS IN FLIGHT OF NEGATIVE HEAVY MESONS. S. Nilsson and Å. Frisk (Univ. of Uppsala). Arkiv Fysik 14, 277-92(1958).

Forty-one m of K^- track length have been followed in the energy interval 0–140 Mev. 208 interactions in flight are analyzed to yield the total cross section per nucleus in emulsion $\sigma = 780 \pm 60$ mb. The corresponding average total nucleon cross section in nuclear matter is calculated to be $\bar{\sigma} = 80 \pm 15$ mb. The mean free path $\lambda = 0.95 \times 10^{-13}$ cm implies a large absorptive potential ~60 Mev. The derived limits on the free neutron cross sections do not contradict the assumption that charge independence holds in the absorption and scattering processes. The differential cross section for elastic scattering between 5°–30° is given. An attractive K^- nuclear potential is inferred from the percentage of re-emerging K^--mesons. (auth)

2382

APPLICATION OF THE METHOD OF TANGENTS TO THE MEASUREMENT OF THE MULTIPLE SCATTERING OF π MESONS STOPPED IN NUCLEAR EMULSIONS. Brigitte Dépaux and Tsai-Chü. Compt. rend. 247, 879-81(1958) Sept. 22. (In French)

A new method of elimination in the techniques of multiple scattering is proposed. The constant K, deduced from the measurement of the multiple scattering of 40 π mesons by the tangential method, is in good agreement with the theoretical value. (tr-auth)

2383

INTERPRETATION OF THE CURVE FREQUENCY DISTRIBUTION, BY NUMBER OF BRANCHES, OF STARS PRODUCED BY COSMIC RADIATION IN NUCLEAR EMULSIONS. Jacqueline Lory, Christiane Lefort, and Simone Desprez-Renaud. Compt. rend. 247, 1185-7(1958) Oct. 20. (In French)

A systematic study was made of the stars produced in nuclear emulsions by a beam of 2.2-Bev protons. A comparison of the results was made with previous results in order to find, from the energy spectrum of the primary protons, the frequency distribution, by number of branches, of the stars produced by cosmic radiation in the stratosphere. (tr-auth)

2384

SCATTERING OF ELECTRON FROM FIVE DIMENSIONAL WAVE EQUATION. A. K. Mitra (Indian Assn. for the Cultivation of Science, Calcutta). Indian J. Phys. 32, 336-9(1958) July.

The solution of the radial part of the five dimensional wave equation for the case of scattering of an electron

in a Coulomb field was considered and it is found that half integral quantum numbers appear in the solution which lends support to the idea that the influence of the fifth coordinate is somewhat analogus to the existence of the spin. (auth)

2385

POLARISATION OF A DIRAC PARTICLE AND PROTON-NEUTRON SCATTERING. S. P. Misra (Ravenshaw Coll., Cuttack, India). Indian J. Phys. 32, 355-64(1958) Aug.

Polarization in nucleon-nucleon scattering in the pseudoscalar meson theory is considered. Attempts have previously been made to explain polarization in scattering by expanding in terms of center of mass angular momentum and considering the scattering problem with the help of phase shifts in the different angular momentum and spin states. This procedure often contains the error of keeping only a few phase shifts. This source of error was avoided by taking the usual S-matrix in the second and fourth orders. Using this direct method, it was observed that polarization in such a scattering case, when initially the particles are unpolarized, is zero. This contradicts experimental results. (auth)

2386

INVESTIGATIONS OF THE ANGULAR DISTRIBUTION OF γ QUANTA DURING POSITRON ANNIHILATIONS IN LIQUID HYDROGEN AND HELIUM. A. S. Basina, K. A. Baskova, B. S. Dzhelepov, and M. A. Dolgoborodova (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 968-75(1958) Aug. (In Russian)

Positron annihilation mechanisms are different for metals and amorphous media. An attempt was made to clarify these mechanisms by measuring simultaneously the life time and angular distribution curve and by determining the ratio of the probabilities for triple to double quantum annihilation. Published data show the presence of the triple component in the annihilation time dependence curve equal to $\tau_1 \sim 2 \times 10^{-10}$, $\tau_2 = (1.83 \pm 0.15) \times 10^{-9}$, $\tau_3 = (9.1 \pm 0.5)^{-8}$ sec. These times were combined with the three annihilation mechanisms in parapositronium, in the interaction of positrons with atomic electrons, and in orthopositronium. Evaluations of the relative intensities of the components showed annihilation by parapositronium and orthopositronium formation equal to 5 and 16%, respectively, and 79% annihilation with atomic electrons. The angular distribution of annihilation quanta in liquid hydrogen and helium was investigated. (R.V.J.)

2387

A NUCLEON FORCES AND THE BOND ENERGY OF A PARTICLE IN HYPERNUCLEI. V. A. Filimonov (Lomonosov Moscow State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 1009-12(1958) Aug. (In Russian)

Interactions of barions with π and K meson fields are used for deriving the expression for A-nucleon forces. Using the transformed Hamiltonian, calculations were made of the forces between nucleons and A particles. The A-nucleon forces were calculated analogous to nucleon-nucleon forces calculated by S. Gartenhaus (Phys. Rev. 100, 900(1955)). (R.V.J.)

2388

EXPERIMENTS WITH THE NEUTRINO. G. Lüders (Max-Planck-Institut für Physik, Gottingen, Ger.). Naturwissenschaften 45, 456-8(1958). (In German)

A brief survey is presented of the experimental results in the investigation of the neutrino. 13 references. (J.S.R.)

2389

ON SCHWINGER'S THEORY OF THE MUON. W. S. Cowland (Imperial Coll., London). Nuclear Phys. 8, 397-401(1958) Oct. (2).

The muon self-mass and the contribution to the anomalous muon magnetic moment, arising from an interaction with a heavy Bose particle (σ) postulated by Schwinger, are calculated in lowest order perturbation theory. The parameters involved are then investigated to see whether a large muon self-mass is compatible with the observed magnetic moment of the muon. It is found that, with some reservations, they are compatible when the σ particle has scalar space-time character. (auth)

2390

BOUND STATES AND SCATTERING OF BARYONS IN CONTACT INTERACTION. I. V. Polubarinov (Joint Inst. of Nuclear Research, Dubna, USSR). Nuclear Phys. 8, 444-60(1958) Oct. (2).

The possibility of treating π and K mesons as bound states in the four-baryon interaction theory is considered. The cross section for baryon-baryon scattering is derived within the framework of this theory in the chain approximation. The validity of the first approximation of perturbation theory for the cross section is discussed. (auth)

2391

OBSERVATIONS OF K^--MESON INTERACTIONS IN NUCLEAR EMULSION. G. B. Chadwick, S. A. Durrani, P. B. Jones, J. W. G. Wignall, and D. H. Wilkinson (Cavendish Lab., Cambridge, Eng. and Clarendon Lab., Oxford). Phil. Mag. (8) 3, 1193-1212(1958) Nov.

23.6 meters of K^- meson track in nuclear emulsion have yielded unbiased samples of 815 absorptions at rest and 106 in flight. The corresponding interaction mean free path is $21.5^{+2.3}_{-1.9}$ cm for K^- mesons of energy below 90 Mev. Observations are reported on the disintegration stars themselves and on the charged hyperons produced. It is in particular noted that the angular correlation between hyperon and pion in two-pronged stars is closely that expected for a system without any nuclear interaction in the final state. It is shown that this and other aspects of the situation are most simply explained if the K^- meson is absorbed in the tenuous outer surface of the nucleus from a high Bohr orbit according to the model of Jones, and is not absorbed uniformly throughout the nuclear volume as is usually assumed. This surface absorption model allows of a strong hyperon–nucleon interaction such as appears to be indicated by a variety of other evidence and which would be inconsistent with the volume absorption model. (auth)

2392

COLLISION CROSS SECTION AND ENERGY LOSS OF SLOW ELECTRONS IN HYDROGEN. G. Bekefi and Sanborn C. Brown (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 112, 159-64(1958) Oct. 1.

Values for the collision cross section for momentum transfer and the fractional energy lost by an electron on collision with a hydrogen molecule were obtained from measurements of the microwave conductivity of a gaseous plasma. The experiments were made in the afterglow of a pulsed discharge in a cavity resonating at a wavelength of 10 cm. The mean electron energy was varied from 0.04 ev (room temperature) to 0.08 ev by heating the gas, and from 0.04 ev to 1.6 ev by microwave agitation of the electrons alone. The collision probability in molecular hydrogen at electron energies

in the neighborhood of 0.04 ev is found to be $28.5(v/v_0)^{0.55}$ $(cm\text{-}mm\ Hg)^{-1} \pm 3\%$, where v is the electron velocity, and v_0 the most probable velocity at 300°K. Measurements in deuterium gas gave the same result. The collision probability in hydrogen increases to a peak value of 64 $(cm\text{-}mm\ Hg)^{-1} \pm 7\%$ at an electron energy of approximately 1.4 ev. The energy loss of electrons near room temperature was found by comparing the conductivity measurements obtained by thermal agitation with those obtained by microwave agitation of the electrons. The fraction of the excess electron energy lost on collision with the hydrogen molecule is $(3.5 \pm 0.5) \times 10^{-3}$. In the higher energy range, the loss and the collision probability were computed from a comparison between microwave conductivity measurements and electron drift velocity and diffusion experiments. (auth)

2393

MULTIPLE SCATTERING OF PROTONS. Hans Bichsel (Rice Inst., Houston, Texas and Univ. of Washington, Seattle). Phys. Rev. 112, 182-5(1958) Oct. 1.

Multiple scattering has been studied experimentally for protons of energy between 0.7 and 4.8 Mev in several metals. Agreement with Molière's theory of multiple scattering is found for both the shape of the distribution function and its width within the errors of the experiment (3 to 5%), except possibly below 1 Mev. A Gaussian curve deviates considerably from the observed distribution at large angles, and therefore does not appear to be suitable for the description of multiple scattering. (auth)

2394

RADIATIVE CORRECTIONS TO MUON AND NEUTRON DECAY. S. M. Berman (California Inst. of Tech., Pasadena). Phys. Rev. 112, 267-70(1958) Oct. 1.

The corrections to muon decay due to electromagnetic interactions have been recalculated. The results differ from those of Behrends, Finkelstein, and Sirlin, because those authors used an inconsistent method for handling the infrared divergences which arise separately in the real and virtual processes. The disagreement is especially significant near the end of the electron (positron) spectrum where the results indicate that the radiative correction to the Michel ρ parameter is approximately 1% larger than previously supposed, a result in the direction of increasing agreement between experiment and theory. With the radiative corrections to muon decay given, the predicted value of the muon lifetime using the universal theory is $(2.27 \pm 0.04) \times 10^{-6}$ sec. As a preliminary to studing the decay of particles with structure, the β decay of the neutron is examined. This leads to an increase in the Coulomb F factor independent of the nuclear charge and of amount approximately 2.6%. As a result the universal coupling constant obtained from the decay of O^{14} is decreased to $G = (1.37 \pm 0.02) \times 10^{-49}$ erg cm^3 and increases the value of the muon lifetime to $(2.33 \pm 0.05) \times 10^{-6}$ sec. (auth)

2395

TESTS FOR THE SPIN IN THE DECAY OF PARTICLES OF ARBITRARY SPIN. Loyal Durand, III and Leon F. Landovitz (Inst. for Advanced Study, Princeton, N. J.), and Jack Leitner (Duke Univ., Durham, N. C.). Phys. Rev. 112, 273-82(1958) Oct. 1.

The polarization and angular distribution of a spin-½ particle produced in the decay of a fermion of arbitrary spin into two particles of spins 0 and ½, and in the decay of a boson of arbitrary spin into two different spin-½ particles, one of which is a two-component neutrino, are calculated in terms of the general decay amplitudes. The results are applied to the discussion of tests for the spin of the decaying particle. Restrictions on the possible spins are found in terms of inequalities limiting the values of certain test functions applied to the experimental angular distributions and polarizations. The results for the boson decay are used in a discussion of the spin of the $K_{\mu 2}$ and of the possibility of lepton conservation in the $K_{\mu 2}$ and $\pi - \mu$ decays. A limit of 10% nonconservation of leptons is found if the K spin is 0. Application of the spin tests to the decay of the Λ^0 hyperon provides substantial evidence that the Λ^0 spin is ½. (auth)

2396

RELATIVISTIC FIELD THEORY OF UNSTABLE PARTICLES. P. T. Matthews and Abdus Salam (Imperial Coll., London). Phys. Rev. 112, 283-7(1958) Oct. 1.

An attempt is made to clarify the fundamental physical basis of the intrinsic characteristics of unstable elementary particles and to replace the conventional, purely phenomenological, description in terms of decaying states and complex energy levels, by definitions which are consistent with general requirements of relativistic quantum mechanics like Hermiticity, unitarity, and causality. (auth)

2397

DEPOLARIZATION OF POSITIVE MUONS IN CONDENSED MATTER. Robert A. Swanson (Univ. of Chicago). Phys. Rev. 112, 580-6(1958) Oct. 15.

The effects of parity nonconservation in the π-μ-e decay chain are used to measure the depolarization of positive muons in solids and liquids. Depolarization factors are given for some 30 materials, including commonly used experimental media. The asymmetry coefficient α for the angular distribution of positrons emitted by muons from positive pions at rest is found to be 0.303 ± 0.048. (auth)

2398

PRODUCTION OF STRANGE PARTICLES AND ANTIPARTICLES IN NUCLEAR INTERACTIONS OF VERY HIGH ENERGY ($E \sim 10^{13}$ ev). E. Lohrmann and M. W. Teucher (Univ. of Chicago). Phys. Rev. 112, 587-9(1958) Oct. 15.

The production of strange particles, nucleons, and antibaryons (antinucleons and antihyperons) in nuclear collisions of an energy between 10^{12} and 10^{14} ev was studied by looking for high-energy interactions produced by the secondary particles. The ratio of secondary interactions initiated by neutral particles to those initiated by charged particles was found to be $Q = 0.16 \pm 0.06$. Under reasonable assumptions, these data indicate that $9^{+8}_{-4}\%$ of the high-energy charged secondary particles are charged K-mesons or baryons and antibaryons. The average energy of the primary collisions used in our analysis is estimated to be of the order of 10^{13} ev. (auth)

2399

CROSS SECTIONS FOR ASSOCIATED PRODUCTION BY PROTONS. David Berley and George B. Collins (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 112, 614-18(1958) Oct. 15.

Associated production from different target nuclei has been investigated by detecting gamma rays originating from unstable particles which decay downstream of a target bombarded with 3-Bev protons. The varia-

tions in the intensities of these observed gamma rays with atomic weight of the target nucleus indicate that an appreciable fraction of heavy meson and hyperon production occurs as a result of some two-step process, such as intermediate π production. For processes which involve production of Σ^0, Λ^0, or K^0 by p-p and by p-n collisions, the ratio of the cross sections for associated production is $\sigma_{pp}/\sigma_{pn} = 0.2 \pm 0.3$. (auth)

2400

NEGATIVE K-MESON REACTIONS WITH PROTONS: MASSES OF CHARGED Σ HYPERONS AND THE NEGATIVE K MESON. Walter H. Barkas, John N. Dyer, Peter C. Giles, et al. (Univ. of California, Berkeley). Phys. Rev. 112, 622-3(1958) Oct. 15.

New measurements of the masses of the charged Σ hyperons and the negative K meson are reported. The results obtained are $M_{\Sigma^+} = 1189.3 \pm 0.3$ Mev, $M_{\Sigma^-} = 1195.8 \pm 0.5$ Mev, and $M_{K^-} = 493.87 \pm 0.46$ Mev. No evidence for more than one K^--meson mass was found. The terminal behavior of the Σ^- hyperons was also studied. (auth)

2401

RELATIVE PARITY OF CHARGED AND NEUTRAL K-PARTICLES. A. Pais (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 112, 624-41(1958) Oct. 15.

Neither from the experimental nor from a theoretical point of view is it obvious that the relative parity p(K) of charged and neutral K-particles is even. This paper is devoted to a study of the case of odd p(K). It is shown that in the approximation $\delta \equiv (M_\Sigma - M_\Lambda)/M_\Lambda = 0$ the π-nucleon phenomena are charge independent provided certain coupling-constant relations are satisfied. The strong Λ-neutron and Λ-proton forces are no longer equal, but if π-interaction between Λ and nucleon predominates this equality is still nearly true. Σ- and K-mass differences may occur which are not mediated by the electromagnetic field. The effects of finite δ on π-nucleon charge independence deviations are explored. Charge symmetry is also violated. These deviations appear not to be disturbing. It is shown that the possibility exists of a negative contribution of a new kind to the proton-neutron mass difference, π-baryon and K-baryon couplings alone would lead to contradictions with experiment. These can be overcome by introducing a KKπ-coupling; for odd p(K) this is compatible with parity conservation. A qualitative explanation of K-exchange scattering is given which is not unsatisfactory. The consequences for elastic K-scattering are discussed. For ΣK-production in π-nucleon collisions the possibility exists of a violation of the triangle inequalities. There appears to be a good promise for understanding the forward (backward) peaking of charged (neutral) hyperons in associated production. It is pointed out that the K-pair effects due to KKπ-interaction lead to further violations of charge independence. The main effect anticipated is for π-nucleon S-scattering. The influence of a lack of charge symmetry on the nucleon-charge distribution is commented on. The symmetries of the strong interactions classified in terms of the four-dimensional real orthogonal group are studied. Full four-invariance is broken by parity. It is conjectured that each symmetry class is characterized by one universal coupling constant. The main points of direct experimental interest are summarized. (auth)

2402

INTERACTION CURRENT IN STRANGENESS-VIOLATING DECAYS. S. Okubo and R. E. Marshak (Univ. of Rochester, N. Y.), E. C. G. Sudarshan (Harvard Univ., Cambridge, Mass.), W. B. Teutsch (Tufts Univ., Medford, Mass.), and S. Weinberg (Columbia Univ., New York). Phys. Rev. 112, 665-8(1958) Oct. 15.

The consequences of the hypothesis that the current of strongly interacting particles contributing to strangeness-violating decays has the transformation properties of an isospinor are investigated. The six processes $K^+ \to \pi^0 + \mu^+ + \nu$, $K^- \to \pi^0 + \mu^- + \bar{\nu}$, $K_1^0 \to \pi^+ + \mu^- + \bar{\nu}$, $K_1^0 \to \pi^- + \mu^+ + \nu$, $K_2^0 \to \pi^+ + \mu^- + \bar{\nu}$, $K_2^0 \to \pi^- + \mu^+ + \nu$ would then have the same rates, angular correlations, spectra, etc., and likewise for electron modes. This prediction is compared with available experimental data. The evidence from the nonlepton decays is briefly examined. (auth)

2403

BETA DECAY OF THE Λ. Frank S. Crawford, Jr., Marcello Cresti, et al. (Univ. of California, Berkeley). Phys. Rev. Letters 1, 377-80(1958) Nov. 15.

In the course of studying a large number of decays of hyperons, produced in a hydrogen bubble chamber by 1.23 Bev/c pions, an unambiguous case of a Λ undergoing beta decay was found. The events at the various vertices in the photograph are analyzed. (W.D.M.)

2404

LEPTONIC DECAYS OF HYPERONS. Paul Nordin, Jay Orear, et al. (Univ. of California, Berkeley). Phys. Rev. Letters 1, 380-2(1958) Nov. 15.

An event was found in the film taken in the course of an experiment in which an electrostatically separated K^- beam was passed into the Berkeley 15-inch hydrogen bubble chamber which was interpreted to be a beta decay of a lambda hyperon. It was concluded that a Λ produced by the K^- decayed via the process $\Lambda \to p + e^- + \bar{\nu}$. A justification for this interpretation is given. (W.D.M.)

2405

ON THE INTERPRETATION OF THE ATMOSPHERIC EFFECTS ON THE HARD COMPONENT OF THE COSMIC RADIATION. H. Trefall. Univ. i Bergen Arbok Naturvitenskap. Rekke No. 9-15, 18p.(1956).

The atmospheric effects on the hard component of cosmic radiation near sea level are usually represented by the empirically established regression equation $\Delta I/I = \beta_1 \Delta B + \beta_2 \Delta H + \beta_3 \Delta T$, where I is the intensity, B is the barometric pressure at ground level, H is the height of the 100 mb or 50 mb level, and T is the atmospheric temperature in the neighborhood of that level. The interpretations of the various terms of the above equation are discussed. It is shown that the barometer term is not due to pure mass absorption alone, about one third of the effect being due to the instability of the μ mesons. The third term (the positive temperature effect) is shown to be due primarily to second-order effects of the μ—e decay in the cases of measurements performed at the ground near sea level. The positive temperature effect that arises because of competition between disintegration and nuclear capture of π mesons is discussed in some detail, and it is shown that reproduction of π mesons in meson-initiated nuclear interactions makes this effect much smaller than has usually been believed. (auth)

2406

DIFFRACTION PHENOMENA IN FAST PARTICLE COLLISIONS WITH NUCLEI. A. I. Akhiezer and I. Ya. Pomeranchuk. Uspekhi Fiz. Nauk 65, 593-630(1958) Aug. (In Russian)

The semiphenomenological theory of diffraction phe-

nomena at high energies was developed on the basis of the generalized Huygens principle, and the principal results derived from this theory are presented. A general bond between the probability of inelastic processes and the amplitude of elastic scattering is present in high-energy and small-angle scattering. Consequently, in determining the various diffraction processes at high energies, it is sufficient to determine the amplitudes of elastic scattering which can be found from the behavior of the wave function of the particle located far from the nucleus. The wave function of such particles has an appearance of superposition of wave plane and wave diffraction from nucleus (black or semitransparent). The latter can be found with the optical method by means of the Huygens principle. (R.V.J.)

2407

THEORY OF THE VELOCITY DISTRIBUTION OF MULTIPLY SCATTERED NEUTRONS IN EXTENDED MEDIA UNDERGOING THERMAL MOTION. Carl C. Grosjean. Thesis, University of Gent, Belgium, 1955. 167p. (In Dutch)

The velocity distribution of neutrons multiply scattered in an infinite medium which is being subjected to thermal agitation was studied. The several probability functions entering the problem are calculated. The general equations which must be satisfied by the desired velocity distributions of slowed-down neutrons for any given energy dependence of the cross section are derived. The neutron velocity distribution in the case of 1/v laws for the cross sections and a nuclear mass M = 1 and for the case of 1/v laws for the cross sections and an arbitrary nuclear mass is investigated. An attempt was made to give an exact description of the neutron spectrum by means of only one formula which is valid at all velocities and with both scattering and capture cross sections being completely arbitrary. (J.S.R.)

Heat Transfer and Fluid Flow

2408 MND-1062-1(Rev.)

Martin Co., Baltimore.

NUCLEATE BOILING. LITERATURE SEARCH. J. J. Jicha and E. J. Lemanski. Aug. 1958. 56p. Contract DA-44-009-ENG-3043.

Revised supplement to MND-1062.

The mechanism of boiling heat transfer is described including the effects of various liquid conditions. Forced convection and nucleate boiling heat transfer are considered in addition to partial film boiling. Equations are presented for various pressure ranges, flow rates, and heating element geometries from which boiling locations can be predicted. Also included is a listing of equations which define conditions under which burnout would occur. Some of the more important variables and their effect on nucleate boiling and burnout are discussed, and a glossary of boiling heat transfer terms is included. 210 references. (J.R.D.)

2409 NP-tr-180

EFFECT OF LENGTH OF PIPE ON CRITICAL HEAT FLUX IN FORCED MOTION OF A STEAM-AND-WATER MIXTURE. M. A. Styrikovich and L. E. Faktorovich. Translated by V. Beak (U.K.A.E.A. Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 120, 1018-20(1958). 7p.

The effect of the length of the experimental section upon critical heat flux in forced motion of a steam and water mixture through a pipe was investigated. Pressures were varied from 76 to 180 atmospheres, velocities from 850 to 3000 kg/m^3-sec, and relative enthalpy from −0.3 to 1. The results are discussed, including substantiation of conclusions. (J.R.D.)

2410

LOCAL SHELL-SIDE HEAT TRANSFER COEFFICIENTS IN BAFFLED TUBULAR HEAT EXCHANGERS. T. W. Ambrose and J. G. Knudsen (Oregon State Coll., Corvallis). A. I. Ch. E. Journal 4, 332-7(1958) Sept.

An experimental study of local heat transfer coefficients in a baffled tubular heat exchanger for five baffle spacings and two tube spacings ($2^3/_{16}$-in.-pitch, four-tube bundle, and $1^1/_4$-in.-pitch, fourteen-tube bundle) is reported. Shell-side air-flow rate was constant for all runs. The variation of the local heat transfer coefficient around the tubes and along the length of the tubes for each tube spacing and baffle spacing was investigated. Average shell-side heat transfer coefficients were evaluated from local values and were found to agree with average values reported in the literature. These average values varied with the six-tenths power of the mass velocity in the heat exchanger. The average Nusselt number and the pressure drop across the exchanger each increased at about the same rate as the number of baffles was increased from two to ten. The average heat transfer rate decreased with decreased tube spacing. This effect was evident from the local heat transfer coefficients, and it is explained on the basis of the mechanism of flow around tubes. An eddy flow zone was detected between the baffles. Average heat transfer rates in the eddy and cross flow zones were almost equal and were about 15% below the average rate in the longitudinal-flow zone. The variation of the average heat transfer coefficient along a tube definitely showed the effects of baffles. High coefficients occurred in the baffle holes and in the baffle windows. (auth)

2411

CALCULATION BY SERIES EXPANSION OF THE HEAT TRANSFER IN LAMINAR, CONSTANT-PROPERTY BOUNDARY LAYERS AT NONISOTHERMAL SURFACES. Nils Frössling (Royal Inst. of Tech., Stockholm). Arkiv Fysik 14, 143-9(1958).

A constant-property analysis of the heat transfer at a nonisothermal surface of a blunt body has been made by means of series expansions of Blasius type for two dimensional and axially symmetrical laminar flow. The temperature of the surface and the velocity at the edge of the boundary layer are assumed to have power series distributions. Some new terms, containing universal functions, must be added to the existing solutions for heat transfer at isothermal surfaces, earlier published by the author. Some of these functions have been calculated numerically. (auth)

2412

AIR-COOLED HEAT EXCHANGERS. Ennis C. Smith (Hudson Engineering Corp., Houston, Texas). Chem. Eng. 65, No. 23, 145-50(1958) Nov. 17.

The advantages of air as a coolant are generalized, and information useful for determining approximate surface, operating power, plan area, weight and prices for air-cooled heat exchanger applications is given. (T.R.H.)

2413

FREE-CONVECTIONAL HEAT TRANSFER FROM A SINGLE HORIZONTAL WIRE. Sigurds Arajs and Sam

Legvold (Iowa State Coll., Ames). J. Chem. Phys. 29, 697-9(1958) Oct.

Free-convectional heat transfer from single, horizontal, heated, 2-, and 3-mil platinum wires was measured in gaseous Ar, N_2, O_2, CO_2, and in liquid $(CH_3)_2CO$, CH_3OH, $C_6H_5CH_3$. The measurements, extending approximately from GrPr = 1 to GrPr = 10^{-5}, satisfied the Senftleben correlation. (auth)

2414
ANALYSIS OF THE STEAM-TURBINE REHEAT CYCLE. J. Kenneth Salisbury. Trans. Am. Soc. Mech. Engrs. 80, 1629-42(1958) Nov.

A method is presented by which the mechanism of the reheat cycle is clearly explained, facilitating evaluation of changes in the system. The method permits methods for analysis of the simple regenerative cycle to be applied by translation of the effect of a change in the low-pressure portion into a net effect on the over-all reheat cycle. The method is developed on a new viewpoint in which the reheat cycle is considered to consist of a low-pressure, high-temperature, regenerative-cycle system upon which is superimposed a high-pressure, high-temperature turbine, a reheater, and additional feedwater heaters. (T.R.H.)

2415
TREATMENT OF MAKE-UP FEEDWATER, CONDENSATE, AND RECYCLE WATER FOR SUPERCRITICAL AND NUCLEAR-REACTOR POWER-PLANT CYCLES. V. J. Calise and J. H. Duff (Graver Water Conditioning Co., New York). Trans. Am. Soc. Mech. Engrs. 80, 1659-75(1958) Nov.

A comprehensive view is presented of the experience and practical knowledge, as well as the thought and advanced ideas employed in treatment of water in such power plants of the future as the supercritical and nuclear power stations. An attempt is made to show where pioneering engineering and scientific developments are being applied with little practical long-range experience to support them. Nevertheless the frontiers of power-plant water-treatment engineering are being advanced and the next few years will show substantial accumulation of actual performance data useful to power-plant designers of the future. (auth)

Nuclear Properties and Reactions

2416 AECU-3885
Ohio State Univ. Research Foundation, Columbus.
SCATTERING STUDIES WITH THE OHIO STATE UNIVERSITY CYCLOTRON. Annual Report [for] September 14, 1957—September 30, 1958. (Report No. 2). H. J. Hausman. Sept. 18, 1958. 75p. RF Project 735. Contract AT(11-1)-503. $12.30(ph OTS); $4.50(mf OTS).

Details of the design and development of components to be included in the scattering system utilizing the Ohio State University cyclotron are presented. A detailed report on the experiments performed with the present scattering system is included. A set of experiments was performed to investigate the occurrence of direct-type nuclear reactions at low particle bombarding energies (6.2 Mev). Experiments on the angular distributions of protons inelastically scattered from thin magnesium targets are reported as well as the angular correlations between the inelastically scattered protons and the gamma rays resulting from the decay of the 1.38 Mev excited state of the residual nucleus Mg^{24}. The angular distribution experiments were performed at various incident beam energies from about 5.0 to 6.2 Mev. Angular correlation experiments were performed at two incident beam energies and at three charged-particle detection angles. (W.D.M.)

2417 AFOSR-TR-58-51
Washington. Univ., Seattle.
THE EXCITATION OF NUCLEAR SPIN TRANSITIONS IN CRYSTALS BY ULTRASONIC OSCILLATIONS. Edwin A. Uehling. Apr. 1, 1958. 19p. Contract AF18(600)-653. (AD-154201).

When these experiments were begun a direct connection between the orientations of nuclear spins in crystals and the lattice vibrations had not been established experimentally. The discovery of such a connection constitutes the principal achievement of this work. Additional objectives which were realized include: (a) the measurement of the vibrational energy which is required in order to disturb the spin orientation by a known amount; (b) a study of the sensitivity of this effect in several distinctly different types of crystals; (c) an attempt to measure an acoustic relaxation parameter known as the phonon relaxation time T_p which has been little studied in the history of physics but which is important in the interpretation of these experiments; and (d) a development of the theory of the processes which are under observation. In addition some studies of quadrupole interactions without specific reference to the interaction with lattice vibrations were made. The purpose of these studies was to investigate the nature of the electric field gradients responsible for the nuclear interaction with the lattice. (auth)

2418 KAPL-M-GES-1
Knolls Atomic Power Lab., Schenectady, N. Y.
AN ENERGY SPECTRUM METHOD FOR THE CALCULATION OF BUILDUP FACTORS FOR 6 MEV GAMMA RADIATION. Gerald E. Sabian. June 27, 1958. 37p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00 (mf OTS).

An improved differential energy spectrum method of calculating buildup factors through laminated shields for 6 Mev gamma radiation is presented. Buildup factors and energy spectra calculated with this method are compared to data presented in NYO-3075 and to the results of Monte Carlo calculations for laminated shields. (auth)

2419 NP-7044
Minnesota. Univ., Minneapolis.
A COSMIC RAY JET IN THE 10^{15} ELECTRON VOLT ENERGY RANGE. P. Fowler, P. S. Freier, E. P. Ney, P. H. Perkins, and C. M. G. Lattes. May 19, 1958. 7p. (Notas de Física Vol. IV, No. 9).

A 22.4-liter stack of emulsions was exposed in Minnesota in September 1956 in a balloon flight at 116,000 feet. The emulsion stack weighed 200 lbs and had dimensions of 16 × 12 × 7 inches. The largest jet found by naked-eye scanning traversed the entire Minnesota half of the stack with a total length of 26 cm. The electromagnetic cascade appeared to be initiated by several gamma rays probably from the decay of two neutral mesons. The energy of the primary alpha particle was estimated to be $\geq 10^{15}$ electron volts. (A.C.)

2420 NYO-7862
Brown Univ., Providence.
REACTION STUDIES WITH FAST NEUTRONS. R. A. Peck, Jr. and H. P. Eubank. Nov. 1, 1958. 32p. Contract AT(30-1)-1082. $6.30(ph OTS); $3.00(mf OTS).

Acquisition of a 20 channel analyzer has accelerated the counter program and increased tritium target usage. Local production of targets has become urgent; preliminary work has been carried as far as possible without specific provision, and this problem is one of the foremost for next year. Emulsion data reduction has been programmed for an IBM 650 now available. Scanning activity has ceased temporarily in indirect consequence of the loss of two research microscopes heretofore in active use. The results of experiments concluded this year include: analysis of response of CsI to heavy charged particles; evidence against the simple surface interaction model for the (n,p) process; two new levels in Mg^{27} of somewhat anomalous character; identification of P^{32} levels and correlation with (d,p) and (n,γ) reaction data and shell model transitions; survey of (n,p) cross sections across proton number 50 with observation of predicted discontinuity for 51 protons; identification of separate compound nucleus and direct contributions to Sb(n,p)Sn; gross structure in (d,p) reactions on Sn^{120} and In^{115}, correlated with the spherical shell model but weakened (presumably) by collective distortion; 12,600 tracks being processed for (n,p) spectra near Z = 50, also relevant to the gross structure problem. (auth)

2421 ORO-180

North Carolina. Univ., Chapel Hill.

NEUTRON CAPTURE CROSS-SECTIONS OF Ag^{107} AND In^{115}. Summary Report on Cross-Section Measurements, (1955-1956). R. H. Rohrer, K. Jones, and E. G. Bilpuch. [Dec. 1, 1956]. 7p. Contract AT(40-1)-1076. (M-6096). $1.80(ph OTS); $1.80(mf OTS).

The problems associated with activation of U^{238} are summarized. Ag^{107} was activated by exposure to a neutron flux until the induced activity reached saturation. From the induced activity for various neutron energies, a relative neutron capture cross section curve was plotted. In addition, activation experiments with In^{115} were performed. The results of the experiments are presented graphically. (J.R.D.)

2422 USNRDL-TR-266

Naval Radiological Defense Lab., San Francisco.

$C^{12}(n,p)B^{12}$ CROSS SECTION FOR 14.9- TO 17.5-MEV NEUTRONS. W. E. Kreger and B. D. Kern. Sept. 23, 1958. 50p.

The cross section for the $C^{12}(n,p)B^{12}$ reaction has been measured for 14.9- to 17.5-Mev neutrons. The neutrons were obtained from the $T(d,n)He^4$ reaction and their flux density was determined by counting the recoil alpha particles or by counting the neutrons directly with a $Li^6I(Eu)$ scintillation counter. A cylindrical plastic scintillator 5 inches in diameter and 3 inches in length served as the carbon-containing target and permitted the counting of the B^{12} decay beta rays in nine consecutive 7-msec intervals during the beam-off period of a pulsed neutron beam cycle. The cross section rises from slightly above the reaction threshold of 13.6-Mev to a value of 29.09 ± 4.36 millibarns at 17.5 Mev. The B^{12} beta decay half life has been redetermined as 18.87 ± 0.50 milliseconds. (auth)

2423

PRODUCTION OF HEAVY UNSTABLE PARTICLES IN EXTREMELY ENERGETIC NUCLEON-NUCLEON COLLISIONS. G. Domokos (Central Research Inst. for Physics, Budapest). Acta Phys. Acad. Sci. Hung. 9, 49-62(1958).

The problem of multiple production of heavy unstable particles is analyzed. Possible reaction schemes are established on the basis of Gell-Mann's theory. In order to apply the Fermi-Landau thermodynamical model to the production of heavy unstable particles, their interaction with pions is investigated. Some characteristic quantities of the two-proton system are calculated by making use of this model. The results seem not to contradict experimental results. (auth)

2424

COLLECTIVE EXCITATIONS OF EVEN-EVEN ATOMIC NUCLEI. A. S. Davydov and G. F. Filippov (Moscow State Univ.). Acta Phys. Acad. Sci. Hung. 9, 169-76 (1958). (In Russian)

The problem of collective excitations in an even-even nucleus possessing axial symmetry is considered. During the calculation it was not assumed that a rotational energy is much smaller than a vibrational energy. For different deformation parameters the energy ratios of the collective excitations and the succession of spins were computed. It is shown that the energy of the collective excitations can be represented as the function of two parameters: $a_0 = \sqrt{c/B}$ and $\delta = \beta_0[B_e/\hbar^2]^{1/4}$. In the region $\delta > 2.5$ the excitation spectrum can be represented as the system of rotational vibrational bands. In the region $\delta < 2.5$ the excitation energy can not be separated into rotational and vibrational components. In the region $\delta < 0.4$ the appearence of some special excitations is possible, in consequence of the negative quadrupole moments of the excited states. A comparison with experiment is carried out. (auth)

2425

(γ,p) REACTIONS WITH FORMATION OF THE NUCLEAR GROUND STATE. V. I. Gol'danskii (Physical Inst. of the Academy of Sciences, SSSR). Acta Phys. Acad. Sci. Hung. 9, 177-84(1958). (In Russian)

The contributions of individual levels to photonuclear (γ,p) reactions were estimated on five light nuclei (B^{10}, C^{12}, N^{14}, O^{16}, S^{32}) which can be obtained by a detailed balance method from experimental data regarding reverse (p,γ) reactions. The maximum cross sections for (γ,p) reactions with the formation of ground state final nuclei sometimes exceed by a very large factor the maximum cross sections in giant resonance. The integral cross sections amount to about 10% of the integral cross section in giant resonance. The marked contribution of individual levels must be considered in comparing the spectrum and angular distribution of photonucleons with calculations from statistical theory. (auth)

2426

STATISTICAL THEORY OF ATOMIC NUCLEI. PART IV. P. Gombas, P. Szepfalusy, and E. Magori. Acta Phys. Acad. Sci. Rung. 7, No. 2, 251(1957). (Translated from Referat. Zhur. Fiz. No. 3, 1958, Abstract No. 5431).

2427

USEFUL DIAGRAM. George D. Freier (Univ. of Minnesota, Minneapolis). Am. J. Phys. 26, 567-8 (1958) Nov.

The relations between many of the parameters in nuclear scattering problems are shown in a simple geometrical construction. (auth)

2428

ANGULAR DISTRIBUTIONS OF NEUTRONS PRODUCED IN THE DISINTEGRATION OF LITHIUM BY 1080-kev DEUTERONS. J. Catalá, R. Font, F. Senent, J. Aguilar, and M. de la Cuadra (Instituto de Optica "Daza de

Valdes", Valencia). Anales real soc. espăn. fis. y quím. (Madrid) Ser. A 54, 163-6(1958) July-Aug. (In Spanish)

The photographic plate method was used to study the angular distributions of neutrons produced in the disintegration of lithium by deuterons. The results are reported, and the total cross sections were calculated. (auth)

2429

FISSION ASYMMETRY. D. R. Inglis (CERN, Geneva, and Argonne National Lab., Lemont, Ill.). Ann. Phys. (N.Y.) 5, 106-40(1958) Oct.

Part I is a simplified treatment of the droplet model. To bring the common fissionable nuclei to the region of the "saddle" in the energy surface, it is necessary to have deformations very far from the spherical shape. To study this region without expanding about a spherical shape, and to clarify some aspects of the process that might otherwise be hidden in large machine calculations, a simplified model of a nucleus near the saddle shape is introduced consisting of a cylinder with hemispherical ends. Relatively simple methods are used for estimating the change in electrostatic self-energy for small changes from this shape, and this is compared with the change of surface energy. A long charged cylinder of this sort does not expand indefinitely in length, and for the empirical values of the constants it always tends to contract. Above a certain minimum length, a neck may develop leading toward fission. The initial instability of the neck is considered under various conditions leading toward either symmetric or asymmetric fission. It is made clear that the neck has a strong tendency to start at the symmetric position, but if started asymmetrically it has a tendency to grow faster because of smaller reduced mass of the system. The droplet model alone does not provide an adequate explanation of the asymmetry of low-energy fission. Part II is a discussion of the origin of fission asymmetry as related to other phenomena, particularly the observed angular anisotropies of fission and the low odd states of even nuclei. It is considered likely that specific nucleon effects may make the nucleus "pear-shaped" in the region of the saddle and beyond. Such effects may be related to, but not nearly as extreme as, the picture of two clusters, one with 50 and the other with 82 neutrons, and perhaps better calculated in terms of a small asymmetric deviation from spheroidal shape. It seems theoretically likely that such a mechanism is effective in some states and not others, and various experimental results on fragment mass distribution and angular anisotropy are interpreted most simply if the ground state and its rotational neighbors have saddles favoring asymmetry but some important excited states do not. (auth)

2430

ON MAYER'S THEORY OF CLUSTER EXPANSIONS. Edwin E. Salpeter (Cornell Univ., Ithaca, N. Y.). Ann. Phys. (N. Y.) 5, 183-223(1958) Nov.

New derivations are presented for Mayer's well-known irreducible cluster expansions (in powers of the density) for the fugacity, for the two-body correlation function and for the n-body correlation function. These derivations are based on the assumption that all the cluster expansions converge (and are thus not suitable for investigating condensation phenomena) but short-circuit much of the combinatorial algebra encountered in previous derivations, by means of relatively simple topological arguments. An expansion is derived for the two-body correlation function for a system involving long-range but weak two-body forces. The first term of this expansion reduces to the Debye-Hückel theory for the special case of Coulomb forces. This expansion differs slightly from one derived previously by Mayer and the problem of analytic continuation, encountered when proceeding to the Coulomb force, is treated differently. Topological methods are outlined for rederiving some integral equations of Kirkwood and Salsburg and of Mayer and Sarolea. (auth)

2431

COLLECTIVE ROTATIONS IN NUCLEI. Felix Villars (Massachusetts Inst. of Tech., Cambridge). Ann. Phys. (N. Y.) 5, 224-42(1958) Nov.

A systematic approach is made to the problem of determining the parameters of collective motion in nuclei. Formulas are given for the moment of inertia of the rotational energy and for the collective g-factor of the magnetic moment. These expressions are not based on the use of a model of the nucleus. Such a model will be needed, however, for the numerical evaluation of the expressions derived. The essential elements of a usable model are briefly discussed. (auth)

2432

EXTENSION OF THE HARTREE METHOD TO STRONGLY INTERACTING SYSTEMS. Joseph B. Aviles, Jr. (U. S. Naval Research Lab., Washington). Ann. Phys. (N. Y.) 5, 251-81(1958) Nov.

A trial solution constructed from two-body functions is applied to a variational treatment of the many-body problem with strong forces. The expectation value of the energy for Bose systems is expressed as a series of cluster integrals, which are evaluated and partially summed by techniques resembling those developed for the treatment of the imperfect gas in classical statistical mechanics. The two-body functions are found to satisfy a simple wave equation, which describes the motion of two particles in a field consisting of the actual two-body potential plus an effective potential resulting from collisions with other particles. This equation represents an extension of the Hartree equation to strongly interacting systems. Analytic solutions of a modification of this equation are found for the case of the hard sphere Bose gas at low density, and are shown to give very good agreement with the results of a nonvariational calculation by Lee, Huang, and Yang. The method is then extended to Fermi systems. The derivation of the cluster series for fermions requires a substantial modification of the classical methods, and leads to more complex results than those obtained for the Bose systems. The results are applied to the evaluation of the ground-state energy of a gas of hard sphere fermions. (auth)

2433

THE WAVE FUNCTION OF NUCLEAR MATTER. A. de-Shalit and V. F. Weisskopf (CERN, Geneva). Ann. Phys. (N. Y.) 5, 282-98(1958) Nov.

A two-body correlation amplitude is derived from the Bethe-Goldstone equation. This correlation amplitude is used to construct a wave function for the A-particle system. It is shown that this wave function is an approximate eigen-function for the A-particle Schrödinger equation. The correction terms, which all arise from three and more particle correlations, are estimated in terms of the nuclear density. (auth)

2434

THE GIANT RESONANCE OF PHOTODISINTEGRATION OF TANTALUM. B. M. Spicer, H. H. Thies, J. E. Baglin, and F. R. Allum (Univ. of Melbourne). Australian J. Phys. 2, 298-309(1958) Sept.

The neutron yield from tantalum has been measured as a function of bremsstrahlung energy, and from this the shape of the cross section for the nuclear absorption of photons by tantalum has been deduced. This cross section shows definite evidence that it is made up of two component parts. The result is in agreement with the theoretical predictions for this nucleus, both regarding the existence of the two components and the energy separation of the two peaks. Using the Danos theory, the intrinsic electric quadrupole moment for tantalum is calculated to be 6.1 barns ± 10 per cent. (auth)

2435

γ-RAY YIELD AND SPECTRA PRODUCED BY IRRADIATING BACKING MATERIALS WITH PROTONS. S. E. Hunt, R. A. Pope, W. W. Evans, and D. A. Hancock (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). Brit. J. Appl. Phys. 9, 443-6(1958) Nov.

Thick targets of copper, silver, gold, tungsten, molybdenum, titanium, tantalum, and tin were irradiated by protons in the energy range 0.6 to 2.8 Mev and the total γ-ray yield measured as a function of proton energy. The γ-ray spectra were also measured for a fixed proton energy of 2.2 Mev. The total γ-ray yields of the materials were found to decrease in the order given above, indicating that tungsten backings produce less total γ-ray background than any other. If high energy γ-rays are being investigated it may be advisable to use tin or gold backings since the γ-ray spectrum from these is concentrated towards the lower energies and can consequently be biased out in the counting equipment, but both materials are rather fragile under heavy proton irradiation. (auth)

2436

NOTE ON THE TWO-STAGE MECHANISM OF THE (γ,d) REACTIONS. J. Sawicki and W. Czyz (Warsaw Univ. and Polish Academy of Sciences). Bull. acad. polon. sci. Cl. 3, 5, No. 6, 631-8(1957). (Translated from Referat. Zhur. Fiz. No. 2, 1958, Abstract No. 2947.)

The high probability of the (γ,d) reaction and the large values of the ratio $\sigma(\gamma,d)/\sigma(\gamma,p)$ can be explained with the aid of a two stage mechanism of (γ,d) reactions: the incident photon is absorbed by a separate nucleon which then joins with another nucleon with a suitable momentum to form a deuteron which leaves the nucleus.

2437

AUGER ELECTRONS OF RaE. Mihomir Novakov (Academical Scientific Council of Yugoslavia). Bull. sci. Conseil acad. RPF Yougouslavie 1, No. 1, 11-12(1953). (Translated from Referat. Zhur. Khim. No. 4, 1958, Abstract No. 10506)

The spectrum of slow electrons emitted by RaE (Bi^{210}) was studied using a magnetic β spectrometer of 0.46% resolution. Three lines with energies of 75, 80 and 86 kev, whose intensity ratio was 2 : 0.8 : 1, were revealed. These lines are explained as follows: Internal bremsstrahlung is observed with the β disintegration RaE → Po. It is subject to an internal conversion so that one of the inner electrons of Po flies out. X-ray quanta are emitted during rearrangement of the electron shells of Po. These quanta can convert, producing Auger electrons. It seems that the Auger electrons with an energy of 75 kev are emitted from the L shell of Po during the K−M transition. The origin of the 80 kev line remains unexplained.

2438

THEORETICAL STUDY OF THE β^- DISINTEGRATION OF RHENIUM-187. Nicole Gilbert. Compt. rend. 247, 868-71(1958) Sept. 22. (In French)

The average life of the β^- disintegration of Re^{187} was calculated for the transition energies in the neighborhood of 1 kev by consideration of the processes of electron creation. The effects of exchange between the atomic electrons and the electron emitted by the nucleus induce a preponderantly indirect electron creation before the direct creation and a negligible indirect β^- emission before the direct β^- emission. (tr-auth)

2439

RANGE-ENERGY RELATION FOR PROTONS IN VARIOUS SUBSTANCES. Yatendra Pal Varshini (Allahabad Univ., India). Indian J. Phys. 32, 373-86(1958) Aug.

A simple relation between the range (R) and energy (E) of heavy charged particles has been proposed: $R = a(E + c)^n$, where, a, c, and n are constants. The relation was shown to be quite successful for proton ranges in a number of substances, up to 100 Mev. (auth)

2440

CONVERSION ELECTRON SPECTRUM OF Gd^{149}. N. M. Anton'eva, A. A. Bashilov, B. S. Dzhelepov, and B. K. Preobrazhenskii (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 895-905(1958) Aug. (In Russian)

The conversion electron spectrum of gadolinium, segregated from a tantalum target irradiated in a synchrotron, was studied with an 0.5% resolving power magnetic spectrometer. The conversion lines varied with time at different rates, indicating the presence of various isotopes. Curves were plotted for each conversion line. Electron conversion lines corresponding to $T_{1/2} = 10 \pm 1$ day were related to Gd^{149} (decay curves are presented). The transition energies and relative intensities of Gd^{149} conversion lines were tabulated and the spectra of Gd^{149} conversion electrons at 200 to 350 and 400 to 550 kev are presented graphically, as well as the conversion lines of $E_\gamma = 149.8$ kev. The data contributed to a determination of multiplicities in Eu^{149} nuclear transitions. The hypothetical decay scheme of $Gd^{149} \rightarrow Eu^{149}$ is presented in two variations. (R.V.J.)

2441

CONVERSION ELECTRON SPECTRA OF Gd^{147} AND Eu^{147}. N. M. Anton'eva, A. A. Bashilov, B. S. Dzhelepov, and B. K. Preobrazhenskii (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 906-18(1958) Aug. (In Russian)

The total conversion spectrum of gadolinium containing lines of several isotopes was investigated. Curves were plotted according to reducing intensity with time. Among the isotopes found was a previously unknown isotope Gd^X with half life $T_{1/2} = 35 \pm 1$ hr. Decay curves for K-conversion lines for transitions 229, 370, and 396 kev are plotted. Results of measurements made for Gd^{147} conversion electrons up to ~400 kev and from ~400 kev to 1.5 Mev are presented diagrammatically. Nuclear transition multiplicities in Eu^{147}, results of Eu^{147} measurements, and experimental curves for the spectrum of Eu^{147} conversion electrons are analyzed. The decay scheme of $Eu^{147} \rightarrow Sm^{147}$ is

supplemented with additional transition lines 76.5, 600, 676, and 800 kev. Hypothetical decay schemes of Gd^{147}–Eu^{147} and Eu^{147}–Sm^{147} are included. (R.V.J.)

2442

INTERNAL CONVERSION COEFFICIENTS OF CERTAIN TRANSITIONS IN Eu^{147} AND Eu^{149}. V. K. Adamchuk, A. A. Bashilov, and B. K. Preobrazhenskii (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 919-26(1958) Aug. (In Russian)

A method for determining internal conversion coefficients which does not require decay scheme data is described. The method is based on measurements of the number of conversion electrons and γ photons (by the photoelectrons) emitted from the same source. Results of calibration experiments made with ThB, Au^{198}, and Cs^{137} are tabulated, and conversion electron spectra for ThB with E_γ = 236.6 kev, Au^{198} with E_γ = 412 kev, and Cs^{137} with E_γ = 661.5 kev are presented. Spectra of Gd^{147} and Gd^{149} conversion electrons and photoelectrons are included. Schemes of basic transition distribution in Eu^{147} and Eu^{149} and the variations in the distribution of the lower levels in Eu^{147}, Eu^{149}, and Eu^{151} transitions are given. (R.V.J.)

2443

CONVERSION ELECTRON SPECTRUM OF As^{73}. E. P. Grigor'ev, B. S. Dzhelepov, A. V. Zolotavin, and V. Ya. Mishin (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 927-30(1958) Aug. (In Russian)

The conversion electron spectrum of As^{73} was studied with an 0.4% resolving power β spectrometer. The energy and relative intensity of conversion line transitions L, (M + N) at 13.5 kev and K, L, and (M + N) at 52.8 kev were recorded. The ratio of the K conversion electron number $h\nu$ = 52.8 kev in As^{73} to the number of conversion electrons $h\nu$ = 596 kev during the measurement was equal to 185. Considering the As^{74} decay scheme, as presented in previous work, and the number of K-conversion electrons in the 52.8-kev transition as equal to 0.8 per decay, the yield of As^{73} is 0.8 ± 0.3 of the As^{74} yield. (R.V.J.)

2444

CONVERSION ELECTRON SPECTRUM OF CERIUM FRACTION. B. S. Dzhelepov, B. K. Preobrazhenskii, I. M. Rogachev, and P. A. Tishkin (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 931-4(1958) Aug. (In Russian)

The conversion electron spectrum of cerium, produced by chromatographic segregation from deep spallation products on Ta, was measured at 30 kev and above with an improved magnetic lens β spectrometer, and in the small energy region, 2 to 2.5 kev, with a β spectrometer. The obtained electron conversion spectrum was plotted, and the energy lines, their possible identification, and relative intensities are tabulated. The observed 15 lines were divided into three groups according to their half life. (R.V.J.)

2445

CONVERSION ELECTRONS OF CERTAIN NEUTRON DEFICIENT ISOTOPES OF Ho AND Er. I. S. Dneprovskii and G. M. Kolesov (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 935-40(1958) Aug. (In Russian)

Conversion electron spectra of erbium produced in deep spallation of Ta by high-energy protons were measured with a magnetic β spectrometer. Four line groups of 30, 3.5, 2.5, and 1 hr half life were observed. Studies were carried out according to the group order. (R.V.J.)

2446

Eu^{155} EMISSIONS. M. P. Glazunov and B. F. Gulev. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 941-4(1958) Aug. (In Russian)

Eu^{155} β and γ spectra and γ transition multiplicities and relative intensities were investigated. Eu^{155} segregated from uranium fission fragments was used in the investigations. Results are tabulated. (R.V.J.)

2447

CONVERSION ELECTRON COINCIDENCES IN THE $Eu^{147} \rightarrow Sm^{147}$ DECAY. B. S. Dzhelepov, B. K. Preobrazhenskii, and V. A. Sergienko (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 945-8(1958) Aug. (In Russian)

A double-lens β spectrometer was used in the investigation of coincidences between conversion electrons formed in the $Eu^{147} \rightarrow Sm^{147}$ ($T_{1/2} \sim 25$ days) decay. The Eu^{147} was obtained from a Ta target bombarded by 660-Mev protons. The neutron-difficient Eu isotopes were segregated chromatographically. The conversion electron spectrum at energies up to 200 kev measured with one half of the spectrometer is presented. The number of conversion lines, their distribution, and relative intensities coincide with the previously published data. Coincidences between transitions 76.3 and 121.0 kev, 197.6 and 121.0 kev, 197.6 and 76.3 kev, and 121.0 and 197.6 kev and K-Auger electrons were investigated as well as coincidences between conversion electrons and K-Auger electrons. (R.V.J.)

2448

CONVERSION ELECTRON COINCIDENCES IN THE $Tm^{167} \rightarrow Er^{167}$ DECAY. B. S. Dzhelepov, B. K. Preobrazhenskii, and V. A. Sergienko (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 949-51(1958) Aug. (In Russian)

A double-lens β spectrometer was used in studies of coincidences between conversion transitions in the $Tm^{167} \rightarrow Er^{167}$ decay ($T_{1/2} \sim 9.6$ days). Tm^{167} was produced in a Ta target by 660-Mev neutrons. Coincidences between conversion electrons in transitions with $h\nu$ = 56.9 and 208.1 kev and between the above electrons and K-Auger electrons were studied. The decay scheme of $Tm^{167} \rightarrow Er^{167}$ and diagrams of the Tm^{167} conversion electron spectrum and of the K–Auger–electron coincidences with conversion electrons are presented. (R.V.J.)

2449

TABLE OF FUNCTIONS FOR DETERMINING THE PROBABILITY OF PERMISSIBLE AND FORBIDDEN L CAPTURE OF NUCLEI. I. M. Band, L. N. Zyryanova, and Yu. P. Suslov (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 952-67(1958) Aug. (In Russian)

Calculations of functions pertinent in the theory of nuclear transitions by means of L-capture are presented. Analysis of electron branching in nuclear capture is of importance in all instances of positron reactivity. For a considerable number of nuclei, orbital electron capture is the only possible means of decay. Detailed tables for K capture are available in the literature; however, for L capture only a few numerical calculations for Z can be found. A series of coefficients depending on the wave function values of L electrons is tabulated, considering

screening effects and finite dimensions of the nucleus. (R.V.J.)

2450

SHIFT AND PROBABILITY OF CORRESPONDING β AND γ TRANSITIONS IN ODD PARITY NUCLEI. V. S. Shpinel (Lomonosov Moscow State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 22, 995-1001(1958) Aug. (In Russian)

Experimental data on the excited states of odd parity nuclei distributed near closed shells are analyzed. (R.V.J.)

2451

NUCLEAR MAGNETIC RESONANCE ABSORPTION IN GLASS. I. NUCLEAR QUADRUPOLE EFFECTS IN BORON OXIDE, SODA-BORIC OXIDE, AND BOROSILICATE GLASSES. A. H. Silver and P. J. Bray (Brown Univ., Providence). J. Chem. Phys. 29, 984-90(1958) Nov.

The nuclear magnetic resonance spectrum of B^{11} has been investigated in several glassy materials containing boron oxide. A value of 2.76 ± 0.05 Mc for the nuclear quadrupole coupling constant of B^{11} has been calculated from the second-order quadrupole perturbation of the $m = \frac{1}{2} \rightarrow -\frac{1}{2}$ resonance line. The same quadrupole interaction has been observed in pure boron oxide, B_2O_3, soda-boric oxide binary glasses, and two commercial borosilicate glasses. The quadrupole coupling constant is interpreted as arising from the bonding electrons in BO_3 groups which comprise the glass network in boron oxide. Addition of oxygen ions to the glass network induces a change in the boron configuration from BO_3 planar groups to BO_4 tetrahedra resulting in a reduction in the quadrupole interaction. This effect has been observed in the $Na_2O-B_2O_3$ glasses and in Corning "Pyrex" and 707 borosilicate glasses. (auth)

2452

N^{14} QUADRUPOLE INTERACTION WITH AN ASYMMETRIC FIELD GRADIENT. P. A. Casabella and P. J. Bray (Brown Univ., Providence). J. Chem. Phys. 29, 1105-7(1958) Nov.

N^{14} pure quadrupole resonances have been found in three compounds having a nonzero asymmetry parameter for the electric field gradient at the resonating nuclei. The shapes of these resonances demonstrate a decrease in the effectiveness of Zeeman modulation as the asymmetry increases, in agreement with theory. (auth)

2453

FORM FACTOR FOR THE EJECTION OF ELECTRONS FROM THE L SUBSHELLS BY PROTONS. M. V. Mihailovic. "J. Stefan" Inst. Repts. (Ljubljana) 3, 55-60(1956). (Translated from Referat. Zhur. Fiz., No. 3, 1958, Abstract No. 5637).

The interactions between protons and the L-shell electrons of the atom are considered in the Born approximation. The form factor occurring thereby is calculated in spherical coordinates. This makes it possible to obtain in analytic form an expression for the form factors individually for the cases of the ejection of an electron from the s-subshell and from the p-subshell of the L shell.

2454

LIFETIME MEASUREMENTS OF THE FIRST EXCITED STATES OF Tl^{208} AND Ra^{224}. J. G. Siekman and H. de Waard (Rijks-Universiteit, Groningen, Netherlands). Nuclear Phys. 8, 402-11(1958) Oct. (2).

Half-lives of $(2.6 \pm 1.0) \times 10^{-12}$ sec for the 40 kev state of Tl^{208} and $(7.0 \pm 1.0) \times 10^{-10}$ sec for the 85 kev state of Ra^{224} have been measured by the line shift method using extremely thin sources especially prepared for these measurements. The method has been checked by determining the latter half-life also from a delayed coincidence measurement, which gave $(7.5 \pm 1.5) \times 10^{-10}$ sec in good agreement with the first value. (auth)

2455

ANGULAR CORRELATION OF THE INTERNAL CONVERSION PAIRS FROM THE 6.09-Mev LEVEL OF CARBON-14 AND THE 5.69-Mev LEVEL OF NITROGEN-14. S. Gorodetzky, P. Chevallier, R. Armbruster, G. Sutter, and A Gallmann (Institut de Recherches Nucleaires, Strasbourg, France). Nuclear Phys. 8, 412-15(1958) Oct. (2). (In French)

The multipolarities of the 6.09 Mev transition in C^{14} and of the 5.69 Mev transition in N^{14}, obtained by bombarding C^{13} with 1.2 Mev deuterons, are determined by measuring the angular correlation of internal conversion pairs. As the resolution of the internal pair spectrometer utilized does not allow one to distinguish between these two transitions, the correlation is studied together for the two transitions, their relative intensities being measured with an external pair spectrometer. The experimental results are compatible only with the spin $J = 1^-$ for the 6.09 Mev level of C^{14} and agree with the value $J = 1^+$ for the 5.69 Mev level of N^{14}. (auth)

2456

COULOMB ENERGIES OF MIRROR NUCLEI. I. Unna (Hebrew Univ., Jerusalem). Nuclear Phys. 8, 468-83 (1958) Oct. (2).

Coulomb energies of mirror nuclei ($A \leq 45$) are calculated using the harmonic oscillator shell model. Correct isobaric spin wave functions have been used. Nevertheless, the results obtained are very close to those of Carlson and Talmi who used wave functions of the protons alone. Some formulas of more general interest, obtained during the calculations, are also included. (auth)

2457

HIGH ENERGY SCATTERING OF DEUTERONS BY COMPLEX NUCLEI. Shigueo Watanabe (Princeton Univ., N. J.). Nuclear Phys. 8, 484-92(1958) Oct. (2).

An effective deuteron-nucleus potential consisting of an optical well plus a spin-orbit interaction was derived, starting from a Saxon potential plus a spin-orbit term for the interaction between each nucleon in the deuteron and the nucleus. The WKB method was used to calculate the angular distribution and the polarization of 94 Mev deuterons by carbon. The result of this calculation using well parameters which fit the scattering data of 40 Mev protons by carbon, is in good agreement with the measured values of the differential cross section. The predicted polarization shows a maximum of about 30 percent, but its sign is constant and does not oscillate as the experimental one does. (auth)

2458

THE ROTATIONAL PROPERTIES OF NUCLEI. Lother Meichsner (Max-Planck-Institut fur Physik, Göttingen, Germany). Nuclear Phys. 8, 493-594(1958) Nov. (1). (In German)

The motion of nucleons in a non-spherical potential is considered. Without changing the dynamical variables of the nucleons, the Hamiltonian and the magnetic moment

operator are put into such a form as to contain collective rotations about axes perpendicular to a body-fixed axis. The transformation yields operators for the tensor Θ of the reciprocal moment of inertia, for a vector W connecting the collective and the individual motions of the nucleons, and for the gyromagnetic tensor G. These quantities are calculated. A set of so-called approximate basis functions describing an independent motion of the nucleons with respect to a rotating system of coordinates and being in accordance with the symmetry properties of the problem is established. Matrix elements of the Hamiltonian and of the nuclear moment operators are calculated. The errors resulting from the occurrence of redundant degrees of freedom are eliminated by the formalism. A typical feature is the appearance of the so-called "Zwangsenergie." The transformation formalism and the approximate basis functions are used to calculate the ground state of Sc^{45}. An orthonormal set of single particle functions containing a deformation parameter and a spin-orbit decoupling factor is established. The ground state function is a linear combination of five approximate basis functions. The function corresponding to the lowest energy clearly predominates. A comparison with the undeformed shell model shows that the calculated energy is too high. This fact seems to be due essentially to the oscillator potential, which does not hold in this region of nucleon numbers. The calculated magnetic moment is in good agreement with the experimental value. The results are discussed, and some other consequences of the formalism are mentioned. A sketch on rotational states is added and also a discussion of some other papers. (auth)

2459

REPULSIVE CORE FORCES IN THE TRITON. J. M. Blatt and G. Derrick (Univ. of Sydney). Nuclear Phys. 8, 602-6(1958) Nov. (1).

A variational calculation is made for H^3 with repulsive core forces fitted to two-body data. The binding energy so found increases with increasing core radius. (auth)

2460

β-γ COINCIDENCE SPECTROMETRIC INVESTIGATION OF THE DECAY-SCHEME OF Nd^{147}. D. Berényi (Hungarian Academy of Sciences, Debrecen). Nuclear Phys. 8, 607-12(1958) Nov. (1).

Beta-gamma ray coincidence investigations were made by means of a magnetic spectrometer and a NaI(Tl) scintillation gamma-ray spectrometer incorporated into the former one in order to determine the number and maximum energy of partial beta-ray spectra at the decay of Nd^{147}. The following beta-ray groups of end point energy were found: 815 ± 10, 529 ± 25, 365 ± 15, and 215 ± 15 kev. (auth)

2461

CHARGED PARTICLES EMITTED FROM ALUMINUM ON BOMBARDMENT WITH 14 Mev NEUTRONS. P. V. March and W. T. Morton (Univ. of Glasgow). Phil. Mag. (8) 3, 1256-61(1958) Nov.

The energy spectra of the charged particles emitted from aluminum on bombardment with 14 Mev neutrons have been measured for the angular intervals 16 to 48° and 132 to 164°. Groups of protons corresponding to known levels in Mg^{27} were found. The ratio of the differential cross section for the forward angular interval to that for the corresponding backward interval was found to be 2.6. (auth)

2462

THE SCATTERING OF LONG WAVELENGTH NEUTRONS BY IRRADIATED AND UNIRRADIATED QUARTZ. E. W. J. Mitchell and P. T. Wedepohl (Univ. of Reading, Eng.). Phil. Mag. (8) 3, 1280-6 (1958) Nov.

Measurements have been made of the transmission of neutrons of wavelengths between 5 and 10 A through 10 cm of unirradiated and pile irradiated Brazilian quartz crystals. The total transmission cross section of the unirradiated crystal varies as $\sigma_A = 0.55 + 1.63\lambda$ in the measured wavelength range. After irradiation with 6.4×10^{18} fast n° cm^{-2}, as indicated by the [S(n°p)P] reaction, additional scattering was found. This amounted to 0.18 barns per molecule between 12 and about 9A rising continuously below 9A. The measurements are discussed in relation to optical absorption measurements and radiation damage theory. (auth)

2463

THE PROPERTIES OF BERYLLIUM-11. D. E. Alburger and D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y.). Phil. Mag. (8) 3, 1332-3(1958) Nov.

Ajzenburg and Lauritsen (1955) suggested that the energy difference between the ground states of Be^{11} and B^{11} should be about 11.5 Mev and that Be^{11} should therefore be stable by about 0.5 Mev against neutron emission. In this case the Q-value for the reaction $B^{11}(n,p)Be^{11}$ would be about −10.7 Mev. Nurmia and Fink (1958) discovered a beta activity of half life 14.1 ± 0.3 seconds induced in boron by the 14-Mev neutrons and ascribed it to Be^{11}. The reaction has been studied by the authors in the same manner. The assignment to Be^{11} has been confirmed, and certain properties of decay have been determined. (A.C.)

2464

DETECTION OF A σ.E ENERGY SHIFT IN POSITRONIUM FORMED FROM POLARIZED POSITRONS. Felix E. Obenshain and Lorne A. Page (Univ. of Pittsburgh). Phys. Rev. 112, 179-82(1958) Oct. 1.

In an experiment designed to set an upper limit on the magnitude of σ.E energy for electrons and positrons, a persistent effect is found on reversing the direction of the electric field E applied to a gas sample in which positronium is formed from polarized Na^{22} positrons. The positronium decay is studied by the two-photon angular correlation technique, and a 5% effect on the narrow-component coincidence rate is occasioned by reversing the 15-kilovolt/centimeter field. The effect reverses sign when the positron spin-polarization just before capture, $P_z = (\sigma_z)$, which is at least 0.25, is reversed by changing the source position. Other observations made concurrently suggest that the highly Stark-mixed (excited) levels of positronium in transient existence may be acting as a spin-filter whose action reverses with E. Such behavior would entail mixing between triplet (heavily mixed S and P) levels and the adjacent (similarly mixed S and P) singlet levels—to which problem quantum electrodynamics has heretofore not been applied. (auth)

2465

HYPERFINE-STRUCTURE SEPARATIONS AND MAGNETIC MOMENTS OF Cs^{127}, Cs^{129}, Cs^{130}, AND Cs^{132}. William A. Nierenberg, Howard A. Shugart, Henry B. Silsbee, and R. J. Sunderland (Univ. of California, Berkeley). Phys. Rev. 112, 186-90(1958) Oct. 1.

The atomic hyperfine-structure separations and mag-

netic moments of four neutron-deficient cesium isotopes were measured by an atomic-beam magnetic-resonance method. Results are given for Cs^{127}, Cs^{129}, Cs^{130}, and Cs^{132}. (auth)

2466

SLOW NEUTRON RESONANCES IN U^{235}. F. J. Shore and V. L. Sailor (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 112, 191-202(1958) Oct. 1

The total and fission cross sections of U^{235} have been measured in the energy range 0.1 to 10 ev on the BNL crystal spectrometer. The capture cross section is derived by combining these data with published scattering cross section data. Analysis of the low-energy resonance structure depends strongly on the interpretation of the "background" cross section which dominates the low-energy region. This "background" cannot be accounted for in terms of observed resonances; however, if it is attributed to the presence of a bound level, approximate parameters for such a level can be obtained. It is seen that the strength Γ_n^0 of the hypothetical bound level is anomalously large. The capture component of the resonances is found to be symmetrical, i.e., of Breit-Wigner shape. However, the fission component of the same resonances is asymmetrical, which indicates that a multilevel formula is necessary for fitting the resonances in the fission cross section. A good but not perfect fit to the data between 0 and 2 ev has been achieved using a multilevel formula which applies to the case of a single fission channel and many capture channels. The remaining small discrepancies in fitting the data indicate that the assumption of a single fission channel is too restrictive, and that one or more additional channels contribute weakly to slow neutron fission in U^{235}. (auth)

2467

RESONANCE THEORY OF NEUTRON CROSS SECTIONS OF FISSIONABLE NUCLEI. Erich Vogt (Atomic Energy of Canada Ltd., Chalk River, Ont., Can.). Phys. Rev. 112, 203-14(1958) Oct. 1.

The general Wigner-Eisenbud resonance theory is used to develop a method of analysis for the neutron cross sections of fissionable nuclei. The method is employed in giving a reasonable description of the low-energy cross sections in U^{235}. The single-level fit for U^{235} is known to be unreasonable. Many-level expressions for the cross sections are derived—the only approximation to the general theory being the neglect of all but a small group of resonances. No explicit reference to fission channels is needed and the many-level expressions require few level parameters: the E_λ, $\Gamma_{\lambda n}$, $\Gamma_{\lambda\gamma}$, and $\Gamma_{\lambda f}$ of the single-level theory for each resonance and a few additional parameters pertinent to the interference between levels. The interference terms are described and shown to be important. Their average value yields information about the number of channels involved in fission. The shape and size of the U^{235} cross sections below 2 ev are fitted to within one or two percent using: (a) only one negative energy resonance of smaller size than in the single-level fit; (b) no additional levels to fit the shape other than the observed levels at positive energies; (c) three interference parameters whose size suggests that there are several fission channels in U^{235}. (auth)

2468

SCATTERING OF LOW-ENERGY NEUTRONS BY DEUTERONS. L. Sartori (Princeton Univ., N. J.) and S. I. Rubinow (Stevens Inst. of Tech., Hoboken, N. J.). Phys. Rev. 112, 214-25(1958) Oct. 1.

Neutron-deuteron scattering lengths are calculated by a new variational method which makes provision for polarization (space distortion) of the deuteron. Central Gaussian potentials are employed to represent the two-body interaction, and the trial function is also Gaussian in nature. The results indicate that polarization is not important in either spin state, expect for that which is automatically provided by the exclusion principle. The calculated scattering lengths are not in good agreement with either of the two experimentally allowed sets. (auth)

2469

NEUTRON ACTIVATION CROSS SECTIONS AT 25 Kev. Rex Booth, William P. Ball, and Malcolm H. MacGregor (Univ. of California, Livermore). Phys. Rev. 112, 226-9(1958) Oct. 1.

Neutron activation cross sections have been measured at 25 kev for 31 isotopes. An Sb-Be photoneutron source was used, and thermal activations served to calibrate the beta- and gamma-detector efficiencies. The cross sections were measured relative to iodine. A comparison was made between measured cross sections and predictions based on known low-energy resonance parameters. (auth)

2470

DIRECTIONAL CORRELATION OF GAMMA RAYS IN Ge^{72}. R. G. Arns and M. L. Wiedenbeck (Univ. of Michigan, Ann Arbor). Phys. Rev. 112, 229-31(1958) Oct. 1.

Directional correlation measurements have been made on the 0.63–0.835 Mev, 2.20–0.835 Mev, 2.49 and 2.51–0.835 Mev, and 1.88–1.46 Mev gamma-gamma cascades in Ge^{72} following beta decay of 14.2-hour Ga^{72}. The level at 0.835 Mev has a spin and parity assignment of 2+ and proceeds to the 0+ ground state by pure electric quadrupole radiation. The 0.63-Mev transition proceeds from a 2+ level at 1.46 Mev to the 0.835-Mev level by radiation which is largely electric quadrupole with a small magnetic dipole admixture. The correlation data are consistent with spin assignments of 2 or 3 for the levels at 3.04, 3.32, and 3.34 Mev. (auth)

2471

GAMMA RADIATION FROM Al^{27} + p AND F^{19} + p. W. A. Ranken, T. W. Bonner, R. Castillo-Bahena, M. V. Harlow, Jr., and T. A. Rabson (Rice Inst., Houston, Texas). Phys. Rev. 112, 239-43(1958) Oct. 1.

Gamma radiations with energies less than 3 Mev have been observed with an intermediate-image lens spectrometer when targets of aluminum and fluorine were bombarded by protons. Gamma-ray spectra from Al + p were obtained for proton energies of 2.4, 3.0, 4.0, and 4.4 Mev. Gamma radiation with quantum energies of 0.845, 1.014, 1.722, 2.216, and 2.992 Mev were observed and are attributed to excited states of Al^{27}. Gamma radiations of 1.369 Mev from Mg^{24} and 2.741 Mev, probably from both Al^{27} and Mg^{24}, were also observed. Internal conversion electrons from the excited states of Al^{27} were observed; the conversion coefficients indicate that the 0.845-Mev radiation is E2 and that the 1.014-Mev radiation is M1. Gamma radiation from F^{19} + p was observed with quantum energies of 1.236, 1.358, and 1.46 Mev. The relative intensities of the γ rays were observed for proton energies of 3.22, 3.65, and 4.27 Mev. (auth)

2472

NUCLEAR SPIN-ELECTRON-NEUTRINO CORRELATION IN FORBIDDEN β DECAY. Adam M. Bincer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 112, 244-58(1958) Oct. 1.

The distribution function correlating the electron and neutrino momenta with the spin orientation of the parent or daughter nucleus is calculated for forbidden transitions with Coulomb effects included. Attention is focused on the β-decay interaction law form and behavior under time reversal. The near equivalence of the VA and STP forms is noted and a generalized substitution law relating the VA, STP, and VASTP forms is derived. A number of experiments distinguishing between the VA and STP forms are discussed in detail. Lastly, experiments testing time-reversal invariance are discussed with special emphasis placed on those terms in the distribution function which are not due to Fierz-like interferences and are not obscured by Coulomb effects. (auth)

2473

$U^{238}(n,2n)U^{237}$ CROSS SECTION FROM 6 TO 10 Mev. J. D. Knight, R. K. Smith, and B. Warren (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 112, 259-61(1958) Oct. 1.

The cross section for the $U^{238}(n,2n)U^{237}$ reaction has been measured with incident neutron energies from 6 to 10 Mev and at 16 Mev. The (n,2n) cross section at each neutron energy was obtained by multiplying the ratio of U^{237} atoms to fission events, measured radiochemically, by the appropriate U^{238} fission cross section. These data, together with the data of other investigators for the 13 to 15 Mev region, are used to outline an (n,2n) cross-section curve from threshold to 16 Mev. (auth)

2474

DECAY OF GADOLINIUM-159. S. S. Malik, N. Nath, and C. E. Mandeville (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 112, 262-6(1958) Oct. 1.

The decay of Gd^{159} has been studied with the aid of a thin magnetic lens beta-ray spectrometer and coincident scintillation spectrometers. Two principal beta-ray groups, with the end-point energies 580 ± 10 and 940 ± 15 kev have been observed to decay with the 18-hour half-life of Gd^{159}, revealing energy levels in the residual nucleus, Tb^{159}, at 56, 136, and 361 kev. The coincidence measurements gave evidence of a third beta component, with the end-point energy of 880 ± 20 kev, coincident with the 56-kev gamma ray. The intensities of the three components (580 ± 10, 880 ± 20, and 940 ± 15 kev) have been estimated to be approximately 20, 6, and 74%, respectively. Internal conversion coefficient measurements indicated the 361-kev gamma ray to be a mixed (M1 and E2) transition. (auth)

2475

ENERGIES OF GROUND AND EXCITED NUCLEAR CONFIGURATIONS IN THE FIRST $p_{\frac{1}{2}}$ REGION. I. Unna and I. Talmi (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 112, 452-61(1958) Oct. 15.

Shell-model analysis is applied to configurations containing both $p_{\frac{1}{2}}$ and $s_{\frac{1}{2}}$ nucleons. Energy levels of excited configurations (often recognized by their parity being opposite to that of the ground state) as well as binding energies are considered. Good agreement is obtained which gives support to the jj-coupling scheme. The results obtained are used for calculating other levels. In particular, the modes of excitation of the first excited 0+ level in O^{16} and the $\frac{1}{2}-$ level in F^{19} are determined. (auth)

2476

GAMMA-RAY THRESHOLD METHOD AND THE $O^{18}(d,n\gamma)F^{19}$ REACTION. J. W. Butler and H. D. Holmgren (U. S. Naval Research Lab., Washington). Phys. Rev. 112, 461-7(1958) Oct. 15.

A neutron threshold technique involving observations of the gamma rays from the de-excitation of the residual excited states is described. A study of the $O^{18}(d,n\gamma)F^{19}$ reaction with this technique has resulted in the observation of neutron thresholds at bombarding energies of 346 ± 8, 525 ± 8, and 584 ± 10 kev. These thresholds correspond to states at 6.048 ± 0.014, 6.210 ± 0.014, and 6.262 ± 0.015 Mev in the F^{19} nucleus, respectively. A detailed gamma-ray spectrum was obtained at a bombarding energy of 1.00 Mev using a single-crystal spectrometer, and another detailed spectrum was obtained at 1.40 Mev using a three-crystal pair spectrometer. Coincidence measurements were made for several of the cascade gamma rays. (auth)

2477

LEVELS IN Cr^{50}, Cr^{52}, Cr^{53}, AND Cr^{54}. W. C. Porter, D. M. Van Patter, M. A. Rothman, and C. E. Mandeville (Franklin Inst., Swarthmore, Penna.). Phys. Rev. 112, 468-74(1958) Oct. 15.

Inelastically scattered proton spectra from targets of natural chromium and targets enriched in Cr^{50}, Cr^{53}, and Cr^{54} have been studied for bombarding energies in the region of 4.3 to 4.6 Mev using a double-focusing magnetic spectrometer, at angles of observation of 91.5° and 136.2°. The enriched targets were prepared by the vacuum evaporation of Cr_2O_3 from a small carbon crucible mounted on a tungsten filament onto gold-leaf backings. Surveys were taken up to at least 2.0-Mev excitation. The following level energies in kev were determined: Cr^{50}, 780 ± 3; Cr^{52}, 1432 ± 5; Cr^{53}, 562 ± 3, 1006 ± 4, and 1287 ± 5; Cr^{54}, 842 ± 6. The new level in Cr^{50} occurs at the energy expected for the first 2+ state. Inelastically scattered proton groups corresponding to the known second excited states of Cr^{52} and Cr^{54} were not of sufficient intensity to be observed. (auth)

2478

ELASTIC AND INELASTIC SCATTERING OF PROTONS BY N^{14}. J. W. Olness, J. Vorona, and H. W. Lewis (Duke Univ., Durham, N. C.). Phys. Rev. 112, 475-80(1958) Oct. 15.

Differential cross sections for the elastic scattering of protons by N^{14} have been measured for proton energies between 1.0 and 4.1 Mev at center-of-mass scattering angles of 90.0° and 168.1°. Above 3.5 Mev the study was extended to four additional angles, 140.8°, 125.3°, 54.7°, and 39.2°, to provide information on a broad resonance near 3.9 Mev and a narrower resonance at 3.980 Mev. These two resonances also exhibit a measurable width for inelastic scattering to the first excited state of N^{14} at 2.31 Mev. All measurements were made with a differentially-pumped scattering chamber containing natural nitrogen gas. The probable error in the cross section is estimated at 3%; the energies of the incident protons were determined to ±3 kev. The data were analyzed to provide information on the resonance energies E_r and total widths Γ. Evidence was found for a previous unreported level with E_r = 2.535 Mev, $\Gamma \cong 1.8$ kev. From an investigation of the elastic and inelastic scattering data in the region of the level at 3.9 Mev it is concluded that the resonance is due to d-wave formation

of a state of O^{15} having spin and parity $5/2^+$, with E_r = 3.878 ± 0.008 Mev, Γ = 85 ± 8 kev, Γ_i = 7 kev. (auth)

2479

NEUTRON NONELASTIC CROSS-SECTION MEASUREMENTS ON CARBON. M. H. MacGregor and Rex Booth (Univ. of California, Livermore). Phys. Rev. 112, 486-7(1958) Oct. 15.

Neutron nonelastic cross sections for carbon have been measured over the energy range from 5.8 to 12.9 Mev. The main features of the carbon nonelastic cross section as a function of neutron energy are a gradual rise from threshold (4.8 Mev) up to 7 Mev, a steep rise from 7 to 8 Mev, and an approximately constant value from 8 to 14 Mev. In the vicinity of sharp resonances in the total cross section, good cross-section determinations are difficult to obtain using present-day sphere transmission techniques. (auth)

2480

SEARCH FOR A $0^- \rightarrow 0^+$ PAIR TRANSITION IN O^{16}. K. E. Eklund and R. D. Bent (Columbia Univ., New York). Phys. Rev. 112, 488-9(1958) Oct. 15.

A search was made for an electron-positron pair transition from the 10.98-Mev 0^- state of O^{16} to the 0^+ ground state using the $F^{19}(p,\alpha)O^{16*}$ reaction and an intermediate-image pair spectrometer. No 10.98-Mev pairs were observed with an intensity as great as 2×10^{-5} that of the 3.86 Mev M1 cascade gamma ray from the 10.98-Mev to the 7.12-Mev 1^- state. This result suggests a lower limit of $\tau > 2 \times 10^{-8}$ sec for the partial lifetime of a 10.98-Mev $0^- \rightarrow 0^+$ pair transition. (auth)

2481

ISOMERS IN Tb^{158} AND Ho^{163}. N. B. Gove, R. W. Henry, L. T. Dillman, and R. A. Becker (Univ. of Illinois, Urbana). Phys. Rev. 112, 489-91(1958) Oct. 15.

The isomeric transition in Tb^{158}, with 10.5-second half life and 111-kev transition energy, is designated M3. The isomeric transition in Ho^{163}, with 0.8-second half life and 299-kev transition energy, is designated E3. (auth)

2482

COMPOUND-NUCLEUS PROCESSES FOR THE REACTION U^{235} + n. E. R. Rae, B. Margolis, and E. S. Troubetzkoy (Columbia Univ., New York). Phys. Rev. 112, 492-7(1958) Oct. 15.

The neutron capture and inelastic scattering cross section of U^{235} are calculated on the basis of the statistical theory of nuclear reactions in the energy region up to 1.1 Mev. To carry out the program, one uses experimental data from the resonance region including the radiation width and the level spacing of the compound nucleus. One also makes use of the measured fission and total cross sections in the energy range considered, the spectrum of excited states of the target, and an exponential level-density law for the compound states. The agreement with experiment is good. (auth)

2483

BORON PLUS DEUTERON REACTIONS. R. W. Kavanagh and C. A. Barnes (California Inst. of Tech., Pasadena). Phys. Rev. 112, 503-11(1958) Oct. 15.

Gamma and alpha emission from the 15-Mev level of C^{12} is investigated in the reaction $B^{11}(d,n)C^{12*}$. An upper limit on the ratio of α to γ radiation from the state is $\Gamma_\alpha/\Gamma_\gamma < 1.5$. The excitation threshold for 15-Mev gamma radiation is 1.633 ± 0.003 Mev, and the cross section is given as a function of bombarding energy up to 3.25 Mev. Resonances are found at 2.180 ± 0.010 and 3.080 ± 0.015 Mev. Momentum analyses of α particles from deuteron bombardment of B^{10} and natural boron reveal no excited states in Be^8 in the range of excitation 9.8 to 14.8 Mev, and no new states in Be^9 below 4.7-Mev excitation. The nature of the 1.75-Mev level of Be^9 is discussed. The branching of the β decay of B^{12} to the 4.43-Mev state of C^{12} is found to be 1.4 ± 0.4%, allowing the unique assignment $J = 1^+$ to the B^{12} ground state, which is presumed to be the analog of the 15-Mev state of C^{12}. Upper limits of (0.00 ± 0.01) and (0.1 ± 0.1)%, respectively, are found for γ rays with $E_\gamma > 6$ Mev and $E_\gamma = 3.2$ Mev following B^{12} decay. The cross section for the production of B^{12} is given as a function of bombarding energy for $0.5 \leq E_d \leq 3.25$ Mev. (auth)

2484

ALPHA DECAY OF DEFORMED EVEN-EVEN NUCLEI. R. R. Chasman and J. O. Rasmussen (Univ. of California, Berkeley). Phys. Rev. 112, 512-18(1958) Oct. 15.

Approximate analytic methods are developed for calculating the amplitudes of alpha partial waves at the surface of deformed even-even nuclei. A two-term expansion modifying the ordinary Coulomb function to account for nuclear quadrupole coupling is applied. The amplitudes of alpha partial waves at the nuclear surface are tabulated for eight choices of phase and three values of the intrinsic nuclear quadrupole moment. A detailed comparison is made between this treatment, that of Fröman, and the numerical integration of Rasmussen and Hansen for Cm^{242}. An approximate method of calculating phase shifts induced by the nuclear quadrupole moment is developed and compared with the results of Rasmussen and Hansen for Cm^{242}. (auth)

2485

PRECISION DETERMINATION OF NUCLEAR ENERGY LEVELS IN HEAVY ELEMENTS. E. L. Chupp, J. W. M. DuMond, F. J. Gordon, R. C. Jopson, and Hans Mark (Univ. of California, Livermore). Phys. Rev. 112, 518-31(1958) Oct. 15.

The low-lying energy levels in 32 isotopes between Z = 62 and Z = 75 have been studied using a high-precision bent quartz crystal spectrograph to determine gamma-ray energies. The gamma rays were produced by the electric (or Coulomb) excitation process. The high proton-beam current of the A-48 accelerator was used to provide the intense sources necessary for these experiments. With this technique, energies in the 100-kev region can be determined with a precision of about one part in 2000. A comparison of the results with the unified model of nuclear structure is given. (auth)

2486

PRECISION DETERMINATION OF GAMMA RAYS FOLLOWING $(p,p'\gamma)$ AND $(p,n\gamma)$ REACTIONS. E. L. Chupp, J. W. M. DuMond, F. J. Gordon, R. C. Jopson, and Hans Mark (Univ. of California, Livermore). Phys. Rev. 112, 532-5(1958) Oct. 15.

The gamma rays following $(p,p'\gamma)$ or $(p,n\gamma)$ reactions in seven isotopes have been studied with a bent quartz-crystal spectrograph. The intense gamma-ray sources necessary for such experiments were provided by bombarding various target materials with large proton-beam currents from the A-48 accelerator. The following reactions and associated gamma rays have been observed: $F^{19}(p,p'\gamma)$, 109.87 ± 0.04 kev; $Ti^{49}(p,n\gamma)V^{49}$, 90.65 ± 0.02 kev, 62.29 ± 0.01 kev; $Mn^{55}(p,p'\gamma)$, 125.87 ± 0.05 kev; $Ni^{61}(p,p'\gamma)$, 67.40 ± 0.01 kev; $Cu^{65}(p,n\gamma)Zn^{65}$, 53.93 ± 0.01 kev, 61.20 ± 0.01 kev, 115.09 ± 0.04 kev; $Ge^{73}(p,p'\gamma)$ 67.03 ± 0.01 kev, and $Se^{80}(p,n\gamma)Br^{80}$ 37.05 ± 0.01 kev. (auth)

2487

ANGULAR DISTRIBUTIONS IN FISSION INDUCED BY ALPHA PARTICLES, DEUTERONS, AND PROTONS. C. T. Coffin and I. Halpern (Univ. of Washington, Seattle). Phys. Rev. 112, 536-43(1958) Oct. 15.

Protons of 11 Mev, deuterons of energies up to 22 Mev, and alpha particles of energies up to 43 Mev were used to study fission fragment angular distributions in the following targets: Bi^{209}, Ra^{226}, Th^{232}, U^{238}, U^{235}, Np^{237}, and Pu^{239}. All of the measured distributions were qualitively similar in that more fragments were emitted forward and backward along the beam direction than sideways. The largest ratios of 0° to 90° differential cross sections were slightly greater than 2 and were obtained in the alpha-particle bombardments. The smallest ratios occurred in the proton bombardments. If one decomposes the fissions observed at a given bombarding energy into symmetric and asymmetric mass components, the anisotropy for each component decreases smoothly as the value of Z^2/A of the compound nucleus increases. The asymmetric anisotropies are larger than the symmetric ones. There is no observable effect of the value of the target spin on the observed anisotropies. It is pointed out that some of the observed features of the anisotropies may be accounted for in terms of the fact that some of the fissions occur only after the evaporation of neutrons. (auth)

2488

REACTIONS OF URANIUM-238 WITH CARBON IONS. Torbjørn Sikkeland, Stanley G. Thompson, and Albert Ghiorso (Univ. of California, Berkeley). Phys. Rev. 112, 543-7(1958) Oct. 15.

The excitation functions for some reactions of U^{238} with monoenergetic C^{12} ions have been measured by use of the stacked-foil technique. The (C,4n) and (C,6n) reactions were found to occur through the formation of a compound nucleus followed by neutron evaporation. The results were consistent with calculations made by a modified Jackson-type treatment. Application of the information from the U^{238} (C,xn) reactions to the calculation of cross sections for the $Pu^{242}(C,4n)Fm^{250}$ reaction was found to give agreement with experimental results. The (C,α4n) reaction probably proceeds mainly by a stripping mechanism, but there is also an indication of evaporation of alpha particles from a compound system. (auth)

2489

ENERGY LEVELS IN F^{18} FROM THE $N^{14}(\alpha,\alpha)N^{14}$ AND $N^{14}(\alpha,p)O^{17}$ REACTIONS. E. Kashy, P. D. Miller, and J. R. Risser (Rice Inst., Houston, Texas). Phys. Rev. 112, 547-52(1958) Oct. 15.

Elastically scattered alpha particles from N^{14} and ground-state protons from the $N^{14}(\alpha,p)O^{17}$ reaction show resonances at 2.88-, 3.09-, 3.60-, 3.67-, 3.72-, 4.00-, 4.05-, 4.11-, 4.28-, 4.50-, and 4.55-Mev bombarding energies, corresponding to excited states of the F^{18} nucleus at 6.65, 6.82, 7.21, 7.27, 7.30, 7.52, 7.56, 7.61, 7.74, 7.91, and 7.95 Mev. Scattering-matrix analysis of the elastically scattered alpha particles, together with angular distributions of the reaction protons, indicate that the 6.65-, 6.82-, 7.21-, 7.27-, 7.30-, 7.52-, 7.91-, and 7.95-Mev states in F^{18} probably have angular momenta and parities of 1^-, 2^-, 4^+, 1^+, 3^-, 3^-, 2^-, and 1^+, respectively. (auth)

2490

RE-EXAMINATION OF THE PARAMAGNETIC RESONANCE OF Np^{239}. M. Abraham, C. D. Jeffries, R. W. Kedzie, and J. C. Wallmann (Univ. of California, Berkeley). Phys. Rev. 112, 553-4(1958) Oct. 15.

The microwave paramagnetic resonance spectrum previously reported for 2.3-day Np^{239} activity incorporated into a crystal of $UO_2Rb(NO_3)_3$ has been reexamined and determined to be due, not to Np^{239}, but to radiation-induced resonance centers. Experiments tentatively suggest that these resonance centers may be Pu^{239} in an unusual oxidation state. An experiment in which Np^{239} nuclei were aligned by static hfs interactions (Pound and Bleaney methods) showed an anisotropy of the γ-ray pattern; this proves that the nuclear spin $I(Np^{239}) > \frac{1}{2}$, in contradiction to our earlier result. (auth)

2491

PHOTONEUTRON YIELDS IN THE RARE-EARTH REGION. E. G. Fuller, B. Petree, and M. S. Weiss (National Bureau of Standards, Washington). Phys. Rev. 112, 554-60(1958) Oct. 15.

The total photoneutron yield curves for Sn, I, La, Ce, Sm, Tb, Ho, Er, Yb, Ta, Au, and Pb have been measured for x-ray energies from 7 to 40 Mev with about one percent statistical uncertainty. The Penfold-Leiss matrix was used to convert these yield curves to integrated neutron yield cross sections directly without smoothing the original activation curves. The cross sections derived from the integral curves were corrected for multiple neutron emission above the (γ,2n) threshold using the statistical model. The widths found for the giant resonances for the closed-shell nuclei decreased from 5 Mev to 3.8 Mev in going from Sn to Pb. The widths for the elements having large nuclear deformations for most of their isotopes were considerably broader. These widths decreased slowly from 8.6 Mev for Sm to 6 Mev for Ta. These widths are consistent with the broadening of the giant resonance to be expected on the Danos model if values of the intrinsic quadrupole moment are taken from Coulomb excitation data. The neutron yield cross sections corrected for multiple neutron emission were integrated to 22 Mev. Using these integrals and defining f by $\int\sigma dE = 0.06(NZ/A)f$, these data gave an average value of $f = 1.34 \pm 0.21$. (auth)

2492

SPLITTING OF THE GIANT RESONANCE FOR DEFORMED NUCLEI. E. G. Fuller and M. S. Weiss (National Bureau of Standards, Washington). Phys. Rev. 112, 560-7(1958) Oct. 15.

Photoneutron yield measurements have been made for terbium, tantalum, and gold with good energy resolution from threshold up to 25 Mev. Neutron-production cross sections were obtained directly from the experimental points without smoothing the raw data. Corrections were made for the multiple production of neutrons above the (γ,2n) thresholds. The giant resonances for terbium and tantalum were found to be split into two resonances as predicted by Okamoto and Danos. The giant resonances for all three nuclei were fitted by the superposition of two Lorentz shape resonance lines. The intrinsic quadrupole moments determined from these fits to the experimental data were: terbium, +5.6 ± 0.6 barns; tantalum, +5.7 ± 0.3 barns; and gold, +1.6 ± 0.6 barns. (auth)

2493

PARITY NONCONSERVATION IN THE DECAY OF FREE AND BOUND Λ PARTICLES. R. H. Dalitz (Univ. of Chicago). Phys. Rev. 112, 605-13(1958) Oct. 15.

A quantitative estimate is made of the branching ratio between two-body and more complicated mesonic decay modes for $_\Lambda He^4$ and $_\Lambda He^4$, as function of their spin J and

the ratio p/s of the s- and p-channel amplitudes in free Λ decay. Comparison with the data on $_{\Lambda}H^4$ decay indicates that J = 1 is rather improbable and that, with J = 0, an upper limit on p/s is about unity, a lower limit of 0.45 being obtained from the observations on up-down asymmetry in polarized Λ decay. The theoretical and experimental values for the nonmesonic/mesonic ratio in hypernuclear decay are compared in the light of these limits on p/s. Assuming validity of the $\Delta T = \frac{1}{2}$ rule, the variations in the π^-/π^0 ratio for decays of light hypernuclei ($Z \leq 2$) due to the effect of the Pauli principle are also estimated. A brief discussion of $_{\Lambda}H^3$ decay is given in an appendix. (auth)

2494

ASYMMETRY IN SCATTERING OF 150-Mev POLARIZED PROTONS IN NUCLEAR EMULSIONS. B. T. Feld and B. C. Maglić (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. Letters 1, 375-7(1958) Nov. 15.

A stack of 600-micron Ilford G-5 emulsion pellicules was exposed to an integrated flux of 3×10^3 protons/cm^2 from the Harvard Cyclotron. The protons, of initial energy 149 ± 3 Mev, emerged from the cyclotron after scattering through 15° by an interval carbon target and had an initial polarization of 72 ± 3%. Results to date include a new technique for polarization measurements using nuclear emulsions, evidence on the nuclear spin-orbit potential, and polarization in small-angle scattering. (W.D.M.)

2495

THE BINDING ENERGIES OF ATOMIC NUCLEI. I. INTRODUCTION AND GENERAL METHOD. R. J. Eden and V. J. Emery (Cambridge Univ., Eng.). Proc. Roy. Soc. (London) A248, 266-81(1958) Nov. 11.

The energy of an atomic nucleus can be written as an expansion in terms of an effective two-nucleon interaction and a trial single-particle potential. The effective interaction can be derived from a phenomenological internucleon potential using a suitable extension of the methods of Brueckner for infinite nuclear matter. Coupled integro-differential equations are obtained for the relative wave functions of pairs of nucleons. These are simplified by using a harmonic oscillator potential to give the one-particle wave functions and by approximating the effects of the exclusion principle. A further modification of the method leads to a generalized perturbation procedure in which the more complicated parts of the internucleon potential occur only in differential equations. A preliminary study is made of various methods for determining the matrix elements of the effective interaction and the relative wave functions. (auth)

2496

DETECTION OF FAST NEUTRONS BY THE ASSOCIATED PARTICLE METHOD. P. L. Okhuysen (Texas Nuclear Corp., Austin) and E. W. Bennett, J. A. Ashe, and W. E. Millett (Univ. of Texas, Austin). Rev. Sci. Instr. 29, 982-5(1958) Nov.

The associated particle method of neutron detection has been used to reduce the background in measurements of the total cross section using neutrons from the D(d,n)He^3 reaction and to measure the time-of-flight of the neutrons that are inelastically scattered when elements are bombarded with T(d,n)He^4 neutrons. The techniques used are described. (auth)

2497

ON A GRAPHICAL METHOD FOR FINDING PHASE-SHIFTS IN THE CASE OF SPINLESS PARTICLE COLLISIONS. Tryggve Grotdal (Univ. of Bergen, Norway). Univ. i Bergen Arbok Naturvitenskap. Rekke No. 9-15, 10p.(1956).

A simple graphical method for finding phase-shifts is described. It is built on well known principles and designed for spinless particle collisions. An attempt is made to describe the (d,a) elastic scattering at 13.7 and 19.1 Mev by the spinless particle scattering formula. The method leads to a fairly good fit at 13.7 Mev. (auth)

2498

EFFECTS OF LOW ENERGY ELECTRONS ON THE p-n TRANSITION IN GERMANIUM. U. B. Soltamov and E. S. Grishin (Kalinin Leningrad Polytechnical Inst.). Zhur. Tekh. Fiz. 28, 1394-6(1958) July. (In Russian)

The action of low-energy electrons on the p-n transitions in Ge in the energy range up to 1000 ev was investigated. The scheme of the experimental apparatus is included. (R.V.J.)

Theory

2499

TOMONAGA'S INTERMEDIATE COUPLING THEORY USING CONFIGURATION SPACE METHODS. K. L. Nagy (Roland Eötvös Univ., Budapest). Acta Phys. Acad. Sci. Hung. 9, 23-48(1958) Nov.

With the intermediate coupling theory using the configuration space methods of the quantum theory of fields the state vector characterizing the real nucleon is determined. The calculations were made for the case of interaction of the nucleon field described by the Dirac equation and the scalar on pseudoscalar meson field. Pair creation is completely disregarded. Remaining within the frameworks of the configuration space method, the recoil of the nucleon is considered. With the aid of the state vector the mean value of some characteristic physical quantities is also calculated. The use of the configuration space method, particularly in connection with the computation of local physical quantities, makes it possible to form a very clear picture about the real nucleon. (auth)

2500

VARIATIONAL METHOD FOR THE SOLUTION OF THE QANTUM-MECHANICAL MANY-BODY PROBLEM. D. Ladanyi (Research Group for Theoretical Physics, Hungarian Academy of Sciences, Budapest). Acta Phys. Acad. Sci. Hung. 9, 115-24(1958).

This paper gives a generalization of the variational method proposed by Macke in the case of an outer potential of spherical symmetry. For a great number of particles and slowly changing potential, this process becomes essentially the generalization of the statistical method based on grouping of the particles according to their azimuthal quantum number. However, it is adaptable also for a few particles without any great difficulty. So as to lessen numerical difficulties, three approximations are given. Calculations were made for the Ar atom disregarding the exchange effect. The calculated energy agrees with the semi-empirical value of Slater within 5%. (auth)

2501

ON THE STATISTICAL TREATMENT OF THE FERMION GAS. I. P. Szépfalusy (Univ. for Technical Sciences, Budapest). Acta Phys. Acad. Sci. Hung. 9, 203-16(1958).

A new statistical method, very similar to the one generalized to contain the Weizsäcker inhomogeneity correction modified by Gombás, is derived. With regard to the approximations introduced, the summation over quantum states need not be approximated by integration but can be carried out exactly. In addition to the determination of the density from the variation principle, more accurate methods are described. It is shown that from Plaskett's equation the density can only be determined within the classical allowed zone, and the proper equation for the forbidden zone is given. (auth)

2502

CALCULATION OF THE ENERGY EXPRESSION IN CASE OF A WAVE FUNCTION BUILT UP FROM TWO ELECTRON ORBITS. E. Kapuy (Research Group for Theoretical Physics, Hungarian Academy of Sciences, Budapest). Acta Phys. Acad. Sci. Hung. 9, 237-9(1958).

The wave function of a system is usually built up by the HLSP and LCAO methods from one-electron orbitals. In the present case, the wave function is built up from antisymmetrical two-electron orbitals $\psi(1|2)$, i.e., $\psi(1|2) = -\psi(2|1)$. The spin coördinates are considered in the theory. The expression $E = H(0) + \Sigma_i(E_i + 2C_i - 2A_i)$ is obtained, where E_i is the energy of an electron pair in the i orbit, C_i is the Coulomb-like interaction energy of one of the electrons in the i orbit with electrons in other orbits, and A_i is the exchange energy of one of the electrons in the i orbit with electrons in other orbits. (J.S.R.)

2503

LAWS OF CONSERVATION. PARITY AND TIME REVERSAL. Ta-You Wu (National Research Council, Ottawa). Am. J. Phys. 26, 568-76(1958) Nov.

The concept of conservation of parity is explained, and the reason for the usual transformation laws for electric charge, electric field, magnetic pole, and magnetic field as scalar, vector, pseudo-scalar, and pseudo-vector, respectively (or, alternatively, as p.s.; p.v; s; v, respectively), is traced to the requirement that the laws of electromagnetism be invariant under inversion. The work of Lee, Yang, Wu et al. is then briefly summarized. The usual canonical transformations in classical dynamics are extended to include time reversal by extending the usual conditions for canonical transformations. Thus upon time reversal the Poisson brackets undergo a change of sign. If the behavior of the quantum Poisson brackets upon time reversal is analogously defined, it seems to provide an alternative view to the invariance of the Schrödinger or Heisenberg equations in quantum mechanics under the Wigner time reversal. (auth)

2504

A PARITY-CONSERVING INTERACTION APPLIED TO K-PION DECAY. W. H. Nichols (Massachusetts Inst. of Tech., Cambridge). Ann. Phys. (N.Y.) 5, 141-55 (1958) Oct.

A specific interaction Lagrangian for an isotopic doublet boson is proposed which, to the first approximation in a perturbation expansion, can account for the lifetimes and branching ratios in K-π decays. Since parity is rigorously conserved in all K-π interactions, the K-meson is described as a parity doublet. The total Lagrangian is invariant under charge conjugation and time reflection. The strong interaction, of the form $g_1\varphi_K^\dagger\sigma\tau\chi_K\chi_\pi$, is a scalar in isotopic space and is invariant under parity conjugation (in order to have scalar and pseudoscalar K masses equal). The weak interaction, of the form $g_w(\sigma + \alpha\,\sigma_0)\tau\chi_K\chi_\pi$, allows a change in total isotopic spin of $\frac{1}{2}$ or $\frac{3}{2}$. The final-state pions are considered to be in plane-wave states. The following dimensionless constants are obtained: $g_1 = 1.6$; $g_w = 5 \times 10^{-8}$; $\alpha = -0.16$. No account is taken of any of the K-decay modes involving neutrinos, nor of the production or scattering properties of the K-particles. The eight theoretically distinct K-mesons are reduced in number to the four actually distinguishable in K-decays. (auth)

2505

AN ESTIMATE OF MASSES OF ISOBARS OF THE NUCLEON IN THE FIXED-SOURCE THEORY. W. Krolikowski. Bull. acad. polon. sci. Cl. 3, 5, No. 3, 269-72(1957) XXIII. (Translated from Referat Zhur. Fiz. No. 2, 1958, Abstract No. 2732.)

It is shown that the masses of the four isobars in the symmetrical pseudo-scalar fixed-source theory are equal to the masses of the four known types of baryons (N, λ, Σ, Ξ) for sensible values of the coupling constant and the radius of the meson cloud of the physical nucleon.

2506

SOME REMARKS ON NON-LOCAL THEORIES. J. Rzewuski. Bull. acad. polon. sci. Classee 3, 5, No. 4, 393-400(1957). (Translated from Referat. Zhur. Fiz. No. 3, 1958, Abstract No. 5241).

A general formulation is proposed for non-local theories, a formulation containing the theory of non-local interactions and the bilocal theory as particular cases. This makes it possible to connect directly the problem of the mass spectrum of elementary particles with the problem of convergence. The proposed formulation is a simple means of observing the consequences of particular models of elementary particles and their interactions, in particular with respect to the convergence problem. The Yukawa and Markov models are considered as particular cases.

2507

CONSERVATION THEOREMS AND EQUATIONS OF MOTION IN COVARIANT FIELD THEORIES. A. Trautman. Byull. Pol'skoy Akad. Nauk Otdel. 3, 4, No. 10, 665-9(1956). (Translated from Referat. Zhur. Fiz. No. 3, 1958, Abstract No. 5139).

2508

ON THE EQUATIONS OF MOTION OF A POLAR-DIPOLE PARTICLE. Nad'. Byull. Pol'skoy Akad. Nauk. Otdel. 3, 4, No. 10, 675-7(1956). (Translated from Referat. Zhur. Fiz., No. 3, 1958, Abstract No. 5210).

2509

A GENERALIZATION OF THE PERTURBATION METHOD OF WENTZEL-KRAMERS-BRILLOUIN TO THE CALCULATION OF THE ENERGY OF A NUCLEON IN ITS MESIC FIELD. Jacques Mandelbrojt. Compt. rend. 247, 871-3(1958) Sept. 22. (In French)

A generalization of the Wentzel-Kramers-Brillouin method is given which permits an approximation of two coupled differential equations. The generalization is used for the calculation of the fundamental state of the nucleon by the method of intermediate coupling for the symmetrical scalar meson theory. (tr-auth)

2510

THE NOMENCLATURE OF PARTICLES. Louis de

Broglie. Compt. rend. 247, 1069-72(1958) Oct. 13. (In French)

The nomenclature recently proposed by Vigier et al., (Compt. rend. 246, 394, 564, 710, and 896(1958)) is combined with the "fusion" theory of particles to give a classification of elementary particles. A tabulation of the proposed classification is presented. (J.S.R.)

2511

THE INTRODUCTION OF PROPER OPERATORS IN THE QUANTUM THEORY OF FIELDS. Guy Rideau. Compt. rend. 247, 1098-1101(1958) Oct. 13. (In French)

The vectors representing the physical particles are constructed by the aid of some hypotheses on the hamiltonian spectra. A definition of the elements of the S matrix was deduced by interposing only the creation and annihilation operators of the particles. (tr-auth)

2512

SUPPLEMENT TO ANTIPROTON SCHEME OF β-DISINTEGRATION. Lubor David. Czechoslov. J. Phys. No. 3, 248-9(1957). (Translated from Referat. Zhur. Khim. No. 5, 1958, Abstract No. 13451).

The possible schemes of β disintegration of nucleons and antinucleons are written, taking into consideration the spin conservation and assuming that the neutrino spin is equal to $\frac{1}{2}$, and the antineutrino spin is equal to $-\frac{1}{2}$.

2513

CONVERSION OF PARITY. Luis Maria Garrido. Energia nuclear (Madrid) 1, No. 3, 45-52(1957) July-Sept. (In Spanish)

An account is given of the investigations in field theory which led to the hypothesis and experimental proof that parity was not conserved in a certain class of weak interactions. These ideas are applied to the two-component neutrino theory and the decay of K mesons. (auth)

2514

ON CORE-TO-PARTICLE INTERACTION FROM CLASSICAL POINT OF VIEW. S. Mukherjee and A. Gupta (Inst. of Nuclear Physics, Calcutta). Indian J. Phys. 32, 330-5(1958) July.

The treatment of the extra-core particle in the semi-rigid model of the nucleus, in a core plus one particle system, in a sense justifies the form of the interaction hamiltonian used in such cases by A. Bohr in his collective model of nucleus. (auth)

2515

THE EXPERIMENTAL DETECTION OF THE NON-CONSERVATION OF PARITY BY MEASUREMENT OF THE CIRCULAR POLARIZATION OF γ RADIATION. H. Schopper (Univ. of Mainz). Naturwissenschaften 45, 453-6(1958). (In German)

A brief survey is presented of the experimental methods and results in the detection of the non-conservation of parity by measurement of the circular polarization of gamma radiation. 16 references. (J.S.R.)

2516

A VARIATIONAL PROCEDURE FOR HARD CORE POTENTIALS. K. V. Laurikainen and Seija Lyytikäinen (NORDITA, Copenhagen). Nuclear Phys. 8, 416-20 (1958) Oct. (2).

A variational procedure proposed by Laurikainen and Euranto for the treatment of the deuteron problem has been generalized as to include hard core potentials. The procedure can, probably, also be applied, if tensor forces and LS-forces are introduced. Numerical results are presented for the case of pure central forces. (auth)

2517

ON THE CONNECTION BETWEEN DEGENERACY AND ROTATIONAL STATES IN THE NUCLEAR SHELL MODEL. H. J. Lipkin (Weizmann Inst. of Science, Rehovoth, Israel). Nuclear Phys. 8, 421-7(1958) Oct. (2).

A method, applicable in systems where a degeneracy exists between states having different angular momenta, is presented for constructing the collective angle coordinate required for the description of rotational states. It is shown that the collective description can also lead to rotational bands having only a finite number of states. (auth)

2518

RELATIONS AMONG DIFFERENT MODELS OF THE NUCLEAR PHOTOEFFECT. J. S. Levinger (Univ. of Birmingham, Eng.). Nuclear Phys. 8, 428-43(1958) Oct. (2).

The collective and shell models of the photoeffect are each idealizations for the complicated behavior of many overlapping compound states reached by photon absorption, and are not expected to agree in detail. We might, however, find agreement between the mean energies calculated from different models. This agreement in mean energy is found between the two-fluid collective model and the shell model (finite square well approximated as two Fermi gases). There is also agreement between collective and shell model calculations of the splitting of the giant resonance for deformed nuclei. (auth)

2519

ON GENERALIZED FOLDY-WOUTHUYSEN TRANSFORMATIONS. D. L. Pursey (Universitetets Institut for Teoretisk Fysik, Copenhagen). Nuclear Phys. 8, 595-601(1958) Nov. (1).

The Foldy-Wouthuysen transformation is generalized in one direction to yield a non-relativistic approximation procedure for an arbitrary number of interacting Dirac particles, and in another direction to give an extreme relativistic approximation for a single particle in an external field. The application of the formalism to high energy scattering is briefly sketched. Ambiguities in the procedure are discussed, and are shown to be equivalent, within the validity of the approximation, to unitary transformations of the approximate theory. (auth)

2520

ASYMPTOTIC SOLUTION OF THE THOMAS-FERMI EQUATION FOR LARGE ATOM RADIUS. J. J. Gilvarry (Allis-Chalmers Mfg. Co., Milwaukee) and N. H. March (The University, Sheffield, Eng.). Phys. Rev. 112, 140-9(1958) Oct. 1.

The general form of the solution ϕ of the Thomas-Fermi equation in the limit of large atom radius x_b is determined as an asymptotic series valid for points x near the atom boundary, by a perturbation on the Sommerfeld inverse-cube form. This generalization of the Coulson-March solution yields the complete form of that part of the asymptotic solution which depends on disposable constants of integration (two in number). The general terms of the series are determined explicitly, and coefficients of leading terms are given numerically as ratios in terms of the disposable constants. The two constants of integration are fixed simul-

taneously, in general, by the requirement of continuity in value and slope of ϕ with the result of a series solution for small x, and by the boundary condition. The general method of obtaining the two constants of integration for a compressed atom as power series in an inverse power $x_b^{-\lambda_2}$ of x_b is outlined, where $\lambda_2 = \frac{1}{2}(73^{\frac{1}{2}} - 7)$; coefficients of leading terms are calculated by making use of numerical results of Kobayashi et al. The products $x_b^2\phi_b$, where ϕ_b is the boundary value of ϕ, and $x_b^I(\phi_i' - \phi_{i,\infty}')$, where $\phi_i' - \phi_{i,\infty}'$ is the difference of the initial slope of ϕ from its value for an isolated atom, are each represented as an asymptotic power series in $x_b^{-\lambda_2}$ for x_b large. The two leading coefficients in the former series and the leading coefficient in the latter are determined numerically to relatively high accuracy and compared with values obtained by Gilvarry from the approximate solution of Sauvenier. The results are used to construct a fitted function for ϕ_b in which only one of five terms appearing is evaluated empirically, and which reproduces accurate numerical values of ϕ_b from solutions of the Thomas-Fermi equation within 0.1%, in general. This accuracy exceeds by a factor of about ten that obtained previously by March and by Gilvarry with fitted functions containing three and two theoretical terms, respectively. The connection between the general asymptotic solution and previous approximate results is discussed. (auth)

2521

VECTOR INTERACTION IN BETA DECAY. Jeremy Bernstein and Robert R. Lewis (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 112, 232-8(1958) Oct. 1.

Further experimental consequences of a beta-decay interaction generated by a conserved vector current, as proposed by Feynman and Gell-Mann, are studied. Utilizing the strong analogy between the conserved beta-decay current, and the conserved charge current, higher multipole corrections to the usual results for allowed transitions are computed, and are related to the corresponding electromagnetic transitions, as was first done by Gell-Mann. The effects calculated include corrections to spectra shapes, beta-gamma directional correlations, and beta-alpha directional correlations. A multipole expansion of the V-A interaction is carried out, including all those terms normally classed as allowed and second forbidden. Applications to several interesting transitions are discussed. (auth)

2522

MINIMUM THEOREM FOR THE INTERACTION RADIUS IN TWO-BODY COLLISIONS. William Rarita and Philip Schwed (RIAS, Inc., Baltimore). Phys. Rev. 112, 271-2(1958) Oct. 1.

A general theorem has been derived for the behavior of a two-body scattering process. It is shown that the phase shift analysis must incorporate at least $\bar{l}$ non-negligible phase shifts, where $\bar{l}$ is determined by the total and elastic cross sections in a simple fashion. For large $\bar{l}$, a minimum value for the interaction radius can be inferred from $\bar{l}$. This result is applied to several scattering experiments which were previously analyzed, and the minimum radius obtained turns out in each case to be quite close to the interaction radius as estimated in the more elaborate discussion. (auth)

2523

QUANTUM FIELD THEORIES WITH COMPOSITE PARTICLES AND ASYMPTOTIC CONDITIONS. R. Haag (Princeton Univ., N. J.). Phys. Rev. 112, 669-73(1958) Oct. 15.

The connection between the Nishijima-Zimmermann method and the Ekstein method of treating collision processes between composite particles in quantum field theory is given. Starting from the point of view that the field is a local observable, the "asymptotic conditions" are proved and generalized. (auth)

2524

STRUCTURE OF PARTICLES IN LINEARIZED GRAVITATIONAL THEORY. R. Sachs and P. G. Bergmann (Syracuse Univ., N. Y.). Phys. Rev. 112, 674-80(1958) Oct. 15.

The invariant character of restrictions imposed on singularities or other sources of the gravitational fields in the Einstein-Infeld-Hoffmann theory of motion in general relativity is examined. A complete classification is provided of sources that can occur in the linearized theory only, in terms of properties that are invariant under Lorentz and "gauge" transformations (the latter designation refers to linearized curvilinear coordinate transformations). Except for several explicitly known solutions, all solutions can be derived from a "supermetric" corresponding to the Hertz potential of electrodynamics. One method of classification is in terms of gauge-invariant integrals over spatial closed surfaces completely surrounding the particles. The motion of each source is determined by its own intrinsic angular momentum and dipole moment. The results do not depend on any particular assumed form of the stress-energy tensor of the sources. (auth)

2525

OPTICAL MODEL OF INELASTIC SCATTERING. T. K. Fowler (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters 1, 371-3(1958) Nov. 15.

Inelastic scattering from a complex nucleus can be regarded as a collision with a single nucleon, a direct interaction, if the multiple scattering within the nucleus prior to this final collision is treated as propagation in a medium characterized by a complex potential V_I. If "nuclear medium" were an unambiguous concept, V_I would equal V_c, the usual optical potential describing the propagation of elastic waves. V_I is derived and, for incident particles as heavy as protons, it is seen to differ from V_c in the respect that $\mathrm{Re}V_I = \frac{3}{5}\,\mathrm{Re}V_c$. (W.D.M.)

2526

MODERN THEORY OF SUPER-CONDUCTIVITY. A. Abrikosov and I. Kholatnikov. Uspekhi Fiz. Nauk 65, 551-91(1958) Aug. (In Russian)

The modern theory of superconductivity based on the copper effect and Bogolyubov methods is presented. The part played by electron Coulomb interactions is explained, though an accurate solution of the problem was not found. However, it is felt that the attenuating effects of Coulomb repulsion appear in the presence of electron interactions through a phonon field. Results based on the principle of the new theory obtained for the behavior of superconductors in high-frequency electromagnetic fields are described. (R.V.J.)

RADIATION EFFECTS ON MATERIALS

2527 ANL-5675

Argonne National Lab., Lemont, Ill.

PRELIMINARY IRRADIATIONS OF THE CERAMIC FUELS UO_2, UO_2–Zr, AND ThO_2–UO_2. Final Report

[on] Metallurgy Program 6.2.2. J. H. Kittel and J. H. Handwerk. July 1958. 29p. Contract W-31-109-eng-38. $1.00(OTS).

A series of preliminary irradiations has been made on ceramic fuels of interest for thermal reactors. Most of the studies were devoted to ThO_2–UO_2 compositions because of certain advantages possessed by this material. ThO_2–2.5 wt. % UO_2 and ThO_2–10 wt. % pellets were irradiated bare and in stainless steel, Zircaloy, and aluminum alloy claddings, with the annulus between the ceramic pellets and the cladding filled with air, a helium–argon mixture, NaK, or lead. It was found that the ThO_2–UO_2 specimens were highly stable under irradiation. The UO_2 and UO_2–Zr specimens showed a relatively greater tendency to fracture during irradiation. Assemblies of ThO_2–10 wt. % UO_2 pellets lead-bonded to aluminum alloy cladding were found to be able to withstand higher heat fluxes without damage than similar assemblies with helium–argon bonding. (auth)

2528 APEX-357

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

ESTIMATED RADIATION STABILITY OF AIRCRAFT COMPONENTS. C. G. Collins, W. J. Stapp, R. C. Fries, and V. P. Calkins. Sept. 1956. Decl. Oct. 23, 1958. 117p. Contracts AF33(038)-21102 and AT(11-1)-171. $2.75(OTS).

The components considered include general types of hydraulic and pneumatic, electrical, and electronic components. Components are defined as either mechanical or electrical devices, which in groups constitute a system. Radiation stability of the components was determined in terms of the hours that the components could be exposed to radiation levels of 2×10^6, 2×10^5, and 2×10^4 rep per hour where the radiation was composed of about 10 rep of gamma to 1 rep of fast neutrons. In this report the assumption is made that the lifetime of a material is limited to a 25 percent change in any one of its physical properties. Since, in general, metals and ceramic materials will undergo very few changes after exposures of thousands of hours in the radiation levels considered, attention has been directed primarily to components that contain organic materials. The results of the study are presented in four sections. The first consists of a discussion of factors influencing radiation damage that are applicable to all types of components. Next, individual sections are devoted to hydraulic and pneumatic, electrical, and electronic components. Each section contains a brief discussion of the problems of the particular type of component, followed by tables of estimated lifetimes. The section on electronic components contains a summary of experimental data in addition to estimates since a fair amount of experimental work has been done with these components. (auth)

2529 MND-RP-1256-2

Martin Do. Nuclear Div., Baltimore.

"METALLO-ORGANIC" POLYMERS. A. J. Restanino. Dec. 1956. 4p.

Presented before First Winter Meeting American Nuclear Society, Washington, D. C., December 10-12, 1956.

The effect of gamma radiation on the rate of polymerization of metal acrylates is described. The composition and properties of some newly developed metallo-organic polymers are presented. (W.L.H.)

2530 NARF-58-43T

Convair, Fort Worth, Tex.

RADIATION EFFECTS—METHODS AND DATA. Oct. 7, 1958. Decl. Nov. 28, 1958. 402p. Project 6(1-9964). Contract AF33(600); 32054. (FZK-9-134).

The best current methods of radiation damage analysis and compilation of available substantiating data are presented. A description of analytical methods is given including application of the techniques to integrating radiation damage considerations and limitations to aircraft system design. The state of the art of radiation damage analysis is discussed, including those factors which need to be determined in more detail. A presentation and substantiation of functional thresholds for aircraft materials and components are presented. (W.D.M.)

2531 NP-6989

Brussels. Centre D'Étude de l'Énergie Nucléaire.

DENSITY OF NEUTRON IRRADIATED LITHIUM FLUORIDE CRYSTALS. J. Spaepen. Sept. 1, 1958. 8p.

Sample density was measured by flotation in suitable mixtures of bromoform, hexanol, and pentanol. The crystal platelets were cleaved from Harshaw single crystals and irradiated in the graphite reactor BR-1 at about 80°C. Thermal neutron doses were measured with indium monitors placed with the samples. The results are presented graphically. (J.R.D.)

2532 USNRDL-TR-262

Naval Radiological Defense Lab., San Francisco.

X-RAY DIFFRACTION TECHNIQUES FOR MEASURING RADIATION DAMAGE IN RUBBER. W. E. Shelberg and L. H. Gevantman. Sept. 19, 1958. 54p.

X-ray diffraction techniques were found to be useful for the characterization and comparison of radiation damage in stretched specimens of cured natural rubber. Damaging radiation effects were compared for two differently vulcanized rubbers irradiated in the stretched, crystalline state. This was accomplished by developing thin sheets of durable, sparingly compounded, cured pale crepe rubber, selecting thin sheets of strong, commercial latex rubber of known recipe and cure, stretching these by a factor of 5 and maintaining them firmly fixed, exposing them to a high irradiance of 1000 kvp x rays in an inert atmosphere until rupture, and periodically assessing stress relaxation as manifested by changes in x-ray diffraction intensities determined by Geiger counting x-ray spectrometer and flat camera techniques. Stretched rubber is extremely sensitive to radiation damage. The pale crepe and latex specimens used ruptured at absorbed doses of 2.2×10^6 and 1.6×10^7 r, respectively. In marked contrast, unstretched rubber exhibits stability of physical-mechanical properties at such low dosage. A hypothesis is proposed which attributes radiation-engendered stress relaxation in stretched specimens to chain cleavage. The stress relaxation was revealed by x-ray diffraction as specimen thinning and crystallinity loss. (auth)

2533 AEC-tr-3466

RECOMBINATION CAPTURE OF NON-BASE CARRIERS IN N-TYPE GERMANIUM BY LATTICE DEFECTS FORMED DURING FAST NEUTRON RADIATION. A. V. Spitsyn and V. S. Vanilov. Translated by Oak Ridge National Lab. Library Staff from Zhur. Eksptl'. i Teoret. Fiz. 34, 530-1(1958). 4p.

The value of the recombination capture of non-ground carriers by radiational disturbance of the crystalline structure of n-type germanium produced by fast neutron irradiation was estimated. The average number of dis-

placed germanium atoms per single neutron scattering ($\overline{N}_d$) was used as a factor in the calculation formula, and the validity of the $\overline{N}_d$ calculation method was verified by additional experimental neutron irradiation of n-germanium. The experimental techniques and results are discussed, and the data are presented in tables. (J.R.D.)

2534

HARDNESS OF NEUTRON-IRRADIATED DIAMONDS. A. C. Damask (Frankford Arsenal, Philadelphia). J. Appl. Phys. 29, 1590-3(1958) Nov.

The amount of wear of neutron-irradiated diamonds relative to unirradiated ones is compared after a standard grinding against silicon carbide. It is found that the amount of wear increases with increasing irradiation, i.e., the diamonds become softer with increasing irradiation. Measurements of density show that it decreases with increasing irradiation. The decrease of cohesive energy of an irradiated diamond is estimated from the number of broken bonds and the strain energy of the density change. The experiments indicate that dislocation motion is not responsible for the wearing of diamonds. (auth)

2535

SOME OBSERVATIONS ON THE EFFECT OF RADIATION ON THE REFRACTIVE INDICES OF CERTAIN GASES. C. M. Crain (Univ. of Texas, Austin). J. Appl. Phys. 29, 1605-6(1958) Nov.

Measurements of the effects of radiation from a nuclear reactor and a Co^{60} source on the resonant frequency of a cavity resonator containing air, argon, and nitrogen at various pressures were made using a 9400-Mc refractometer. The change in resonant frequency of the irradiated cavity is a direct measure of the average free electron density in the gaseous medium inside the cavity resonator. No refractive index change due to ionization was observed for atmospheric air pressure from 100 μ to one atmosphere. A change in the refractive index of a few parts in 10^6 was observed when the cavity contained argon or nitrogen at all pressures from 2 cm of mercury to one atmosphere. (A.C.)

2536

FAST NEUTRON INDUCED LUMINESCENCE IN VITREOUS SILICA AND QUARTZ. William Primak and Robert A. Uphaus (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 29, 972-3(1958) Oct.

A reddish luminescence much more intense than the scattered light was observed in excited fast neutron irradiated vitreous silica and quartz. The cause of this luminescence was investigated. It is probably necessary to observe the detailed behavior of the absorption bands during luminescence in order to identify the luminescence centers; however, this work does not identify the excitation centers as being those with which the tail of the ultraviolet absorption is associated. (J.R.D.)

2537

THE STRUCTURE AND PROPERTIES OF RUBBERS PRODUCED IN IRRADIATION VULCANIZATION. B. A. Dogadkin, Z. N. Tarasova, et al. Kolloid. Zhur. 20, 260-71(1958).

The vulcanization of rubber products by different nuclear radiation sources has aroused great interest in the last years. The irradiated rubber products usually show better mechanical and chemical properties than those vulcanized by present methods. Rubbers of the types SKS-30A, SKI, SKB, and natural rubber were tested. The samples were irradiated in an atomic reactor or by a Co^{60} source with a dose of 10^7 to 10^8 r. The investigation of the infrared absorption spectra shows that in the 5.8μ field a broad absorption band corresponds to the carbonyl groups of acids, aldehydes, and ketones. In the 2.8μ field the absorption band of the hydroxyl groups is shown. The density of the network formed during irradiation vulcanization is determined by the energy dose absorbed and by the type and the composition of the rubber, carbon black, and antioxidant, as well as by the irradiation conditions. The number of cross bonds per 100 ev in an air medium is 12 in extracted butadienstirol rubber, 4 in extracted natural rubber, and 2.5 in technical SKS-30A. The structurization effect is increased by an increase in temperature, and decreased in the presence of an inhibitor (phenyl-β-naphthylamine). A correlation was found between the relative rate of chemical stress relaxation and the density of the vulcanizate network which is caused by the formation of C-C bonds during irradiation. The degree of crystallization in the rubber decreases when the irradiation doses are increased. At a dose of 20 to 30 $\times$ 10^8 r the crystallization is the same as in sulfur vulcanizates of similar network density. Compared with sulfur vulcanizates, the irradiation samples show an aging resistance 4 to 5 times higher at 130°C, a lower residual deformation, a low hysteresis, and a high-temperature resistance. (TCO)

2538

DUCTILE-BRITTLE TRANSITION IN STEELS IRRADIATED WITH NEUTRONS. D. Hull and I. L. Mogford (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 3, 1213-22(1958) Nov.

The yield and fracture stresses of unirradiated and irradiated En2 steel have been measured at 20°, −78°, and −196°C. From the change in yield stress, σ_y (shear), with grain size, 2d, the values of σ_i and k_y in a Petch type equation, $\sigma_y = \sigma_i + k_y d^{-\frac{1}{2}}$, have been determined. The term k_y is unaffected by irradiation to within 5% and σ_i increases at a rate approximately proportional to the cube root of the dose. The effect of irradiation on the grain size transition from ductile to brittle fracture has been determined experimentally at −196°C and estimated from the change in σ_i and the value of k_y for tests at −78° and 20°C. The results are in accord with the predictions of Cottrell's relation $(\sigma_i d^{\frac{1}{2}} + k_y) k_y = \beta\gamma\mu$ for the transition. The transition surface relating grain size, yield stress and temperature has been obtained. (auth)

2539

MEASUREMENTS OF UNIT CELL AND PHYSICAL DIMENSION CHANGES OF MOLYBDENUM AFTER NEUTRON IRRADIATION. J. Adam and D. G. Martin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 3, 1329-32(1958) Nov.

Unit cell and physical dimension changes of molybdenum were measured after irradiation at 30° and also after subsequent annealing. Physical dimension measurements were also made on randomly oriented polycrystalline bars which had been annealed at 750°C. Both batches had 0.01% of iron as principal impurity and showed no significant difference in behavior on irradiation and subsequent annealing. Unit cell measurements were made on photographs taken in a precision x-ray powder camera. The final value of the unit cell size, which was accurate to about 15 parts per million, was derived using the standard Nelson and Riley extrapolation. All samples were irradiated inside a hollow uranium cylinder in the Harwell reactor BEPO. The irradiation position and the method of neutron dose

measurements were the same as Kinchin and Thompson's (1958). In this position the fast and slow neutron fluxes are approximately equal. The results of measurements are graphically shown. (A.C.)

2540

STUDY OF REACTOR-IRRADIATED α-Al_2O_3. J. J. Antal (Ordnance Materials Research Office, Watertown, Mass. and Brookhaven National Lab., Upton, N. Y.), and A. N. Goland (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 112, 103-11(1958) Oct. 1.

Studies are presented on reactor-irradiated alpha aluminum oxide single crystals. These are a continuation of the use of long-wavelength neutron transmission for determining the concentration and types of defects produced in solids by high-energy particle irradiation. The material exhibited crystallographic stability to fast-neutron irradiation at temperatures <40°C, and the results indicate a total number of defects approximately 40 times less than that predicted by current theories. Correlation with macroscopic density changes is good. Examination of the wavelength dependence of the neutron scattering indicated that the damage may be partly Al-O vacancy pairs at room temperature. Annealing of the material produced no decrease in the concentration of defects from room temperature to 400°C, a steady decrease from 400 to 1250°C, and nonuniform changes in neutron scattering and visually observable optical coloring beyond 1250°C. Annealing at a temperature of 1800°C did not remove the coloring, although the density returned to its pre-irradiation value. (auth)

2541

SURFACE EFFECTS IN ELECTRON-IRRADIATED Ge AT 80°K. Walter E. Spear (Purdue Univ., Lafayette, Ind.). Phys. Rev. 112, 362-9(1958) Oct. 15.

Photoconductivity, surface conductance, and Hall and field effect measurements have been made before and after electron irradiations. Before irradiation, both n- and p-type specimens show a photoconductive shoulder in the range of photon energies between 0.70 and 0.55 ev, which is connected with a surface effect. Irradiation with energies below the threshold for the introduction of volume defects (about 400 kev) quenches the photoconductivity in the shoulder and causes an increase in surface conductance in n-type, and a decrease in p-type specimens. 4.5-Mev irradiations (a) extend the shoulder to about 0.49 ev and (b) introduce a sharp peak at 0.39 ev. Both features are due to electronic transitions in the surface region. Field effect measurements with steady fields and a superimposed alternating potential indicate that the shoulder is connected with transitions from the valence band into a group of slow surface states lying between 0.70 and 0.58 ev above the valence band. Irradiation below 400 kev increases the surface potential Y until, in n-type specimens, the Fermi level passes through a high concentration of fast states within 0.05 ev of the conduction band. 4.5-Mev irradiations decrease Y; transitions to a second group of slow states lying between 0.4 and 0.2 ev above the valence band can now take place. (auth)

RADIOACTIVE WASTE

Refer also to abstract 2622.

2542 NAA-SR-2938

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ORGANIC REACTOR WASTE GAS ANALYZER. H. M. Gilrey and R. J. Edwards. Oct. 15, 1958. 19p. Contract AT-11-1-GEN-8. $0.75(OTS).

The design of a waste-gas treatment system for organic moderated reactors requires a knowledge of reactor waste-gas composition, generation rate, and radioactivity. To obtain data on these variables a continuous stream analyzer was constructed to analyze the waste gas from the Organic Moderated Reactor Experiment (OMRE). The major components of this analyzer were: a vapor-phase chromatograph for gas composition, a vibrating reed ionization chamber for radioactivity measurements, a wet test meter for generation rate, and cold traps for condensable materials. (auth)

2543 WAPD-PWR-CP-2636

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.] ION EXCHANGE REMOVAL OF FISSION PRODUCTS FROM HIGH PURITY WATER. DEVELOPMENT WORK ASSOCIATED WITH THE PWR RADIOACTIVE WASTE DISPOSAL SYSTEM. W. T. Lindsay, Jr. and C. S. Abrams. [1957?]. 76p. $12.30(ph OTS); $4.50(mf OTS).

Laboratory experiments and tests associated with in-pile loop operations are reported showing that removal of Cs^{137}, Ba^{140}, Sr^{90}, Ce^{144}, Ru^{106}, Zr^{95}, I^{131}, and other radioisotopes from high-purity water is accomplished by passage through mixed-bed ion exchange columns in the hydrogen-hydroxyl form. Decontamination factors for these isotopes averaged 10^3 across single 30-in. beds for processed volumes up to 7500 column volumes. Decontamination factors as high as 10^9 were observed for Sr^{90}. (auth)

2544

FISSION-PRODUCT DISPOSAL. K. Saddington (United Kingdom Atomic Energy Authority, Windscale Works, Sellafield, Cumb., Eng.). J. Brit. Nuclear Energy Conf. 3, 290-8(1958) Oct.

The problem of the disposal of unwanted radioactive fission products formed during the operation of a nuclear reactor will increase with the increased utilization of nuclear power. In this paper the nature and magnitude of the problem are discussed, the methods used for its solution in the past are described, and some consideration is given to possible future developments designed to ensure that the problem does not at any time limit the growth of the industry. (auth)

REACTORS

General

Refer also to abstracts 2612, 2613, 2615, 2616, 2617, 2618, 2619, 2620, and 2623.

2545 AECU-3862

Division of Construction and Supply, AEC.

ENGINEERING STUDY ON REACTOR SHIELDING. Leon A. Tarbox and Christian Beck. Apr. 1958. 18p.

A study was made to determine variation in construction costs for biological shielding vs. changes in radiation levels and exposure to personnel working around a reactor. The study is based on a hypothetical production type reactor; however, various assumptions have been made to simplify and clarify the analysis. These assumed conditions may be more applicable to those related to an industrial power reactor. Comparisons are made based on the cost of constructing a biological shield that will reduce the radiation level to 1 mrem/hr at the outside

face of the shield, a conservative criterion which is often used. Estimates of comparative costs are made for radiation levels higher by factors of 10, 50, and 100. Comparative cost estimates have also been made for biological shields made of less costly construction materials than in the assumed basic shield. The analyses include all cost items involved, such as reductions in the primary biological shield, in the building size, in the secondary shielding walls, and in the tubings, etc. In a reactor, such as the assumed hypothetical reactor, the reduction in cost, if the radiation levels were allowed to be increased by a factor of 10, was estimated to be $237,000 or 10.3% of the $2,308,000 total costs of the primary biological shield. The possibility of cost reductions was analyzed in relation to the computed radiation levels in the areas around the reactor, and the expected exposure to the individuals working in these areas. (auth)

2546 APAE-Memo-142

Alco Products, Inc., Schenectady, N. Y.

PRIMARY SHIELDING CALCULATIONS ON THE IBM 650 (ROC CODES). S. S. Rosen, P. V. Oby, and R. L. Caton. Oct. 15, 1958. 41p. Contract AT(30-3)-326. $6.30(ph OTS); $3.00(mf OTS).

Four programs written for the IBM 650 to calculate the gamma dose rates in the primary shielding of thermal reactors are described. Their functions are outlined as follows: Program 651-calculates the core attenuation coefficient and equivalent core gamma volumetric source values for a specific core. Program 652-calculates the activation gamma source data in the shield and prepares tabular data in machine storage for Programs 653 and 654. Program 653- calculates the gamma dose rates in the shield due to gammas arising from activation of shield materials. Program 654-calculates the gamma dose rates in the shield due to gammas arising in the core. Gamma photo source values are obtained on the basis of two group neutron flux distributions throughout the reactor core and shield. (W.D.M.)

2547 CF-58-10-106

Oak Ridge National Lab., Tenn.

INSTRUMENT TRANSMITTERS FOR HIGH-PRESSURE, AQUEOUS, NUCLEAR REACTORS. R. L. Moore. Oct. 28, 1958. 29p. Contract W-7405-eng-26. $4.80 (ph OTS); $2.70(mf OTS).

A review of the criteria involved in the selection of primary sensing elements for the measurement of process variables in high-pressure, aqueous, nuclear reactors is presented. Some acceptable types of sensing elements now in use at ORNL are described. (auth)

2548 CF-58-10-111

Oak Ridge National Lab., Tenn.

HRT-CHEMICAL PLANT RUN 16 SUMMARY. O. O. Yarbro. Oct. 9, 1958. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The HRT chemical plant hydroclone loop, designed for the continuous removal of fission and corrosion product solids from the HRT, began radive operation during reactor run 15. Cell equipment was operated without difficulty and only minor troubles were encountered with auxiliary equipment. Operating variables, and data on corrosion product solids' removal during three periods of operation are summarized. Approximately 20% of the stainless steel corrosion products produced in the reactor were removed by the hydroclone. (auth)

2549 GEAP-3068

General Electric Co. Vallecitos Atomic Lab., Pleasanton, Calif.

SUMMARY SAFEGUARDS REPORT FOR THE NUCLEAR TEST REACTOR. C. G. Andre. Oct. 7, 1958. 50p. $7.80(ph OTS); $3.30(mf OTS).

Appendix A of Amendment No. 2 to License Application for Nuclear Test Reactor.

The maximum and minimum transient and steady-state limits of operation for the reactor are set forth. The reactor, facility, and site are described. Reactor facility operating standards and procedures and safeguards and hazards evaluations are discussed. (W.D.M.)

2550 GEAP-3073

General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.

METAL–WATER REACTIONS. I. A METHOD FOR ANALYZING A NUCLEAR EXCURSION IN A WATER COOLED AND MODERATED REACTOR. E. Janssen, W. H. Cook, and K. Hikido. May 1, 1958. 50p. Contract AT(04-3)-189. $1.25(OTS).

An approximate method for analyzing the effects of a nuclear excursion in a water cooled and moderated reactor was developed. This analysis is based on idealized models of the reactor which represent the salient features of the system under investigation; and consists of simultaneously solving ten equations. The primary nuclear shutdown mechanism is the void generated in the liquid moderator due to vaporization and radiolytic gas formation. To evaluate this method of analysis it is applied to the Borax I and Spert I reactors. A comparison of the analytical and experimental results indicates reasonable agreement between calculated and experimental data, but suggests that refinements in the method and input parameters are required. This formulation was prepared as the first step in analyzing the effects of a serious nuclear incident in a water cooled and moderated reactor. The continuing program will consist of improving this model and applying the resulting techniques to particular reactor designs to determine the total weight, temperature, and dispersion of molten metal in the core as a function of time. These results will permit evaluation of the extent of a metal water reaction initiated by a nuclear incident. (auth)

2551 IDO-16474

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

QUARTERLY PROGRESS REPORT FOR MTR-ETR TECHNICAL BRANCHES, FIRST QUARTER, 1958. R. G. Fluharty, ed. Sept. 2, 1958. 61p. Contract AT(10-1)-205. $1.75(OTS).

Heat generation calculations showing a breakdown of U^{235} fission energy in the MTR were completed giving 198 ± 6 Mev per fission. Calculations indicate the necessary control system changes to allow MTR operation with Pu^{239} as fuel. Nondestructive methods of fuel and boron analysis for ETR fuel were developed, and core measurements were made using the new "pinned" plate elements which will receive full water flow. By placing large boron content elements in the center and low content on the outside a long burnout core with fairly uniform heat generation is achieved. Transient power studies were used to demonstrate safety of the control magnet design. The regulating rod control system was studied and recommendations made for modifications to improve operation. Transfer function analysis of heat

exchangers using a space dependent differential equation for the heat exchanger is being applied to a system similar to the ETR for comparison with analyses using a lumped exchanger. Out-of-pile experiments are outlined to study metal-water reactions and initial results described. Thorium irradiation calculations and U^{233} build up measurements are summarized. RMF control element modifications allow direct reading to 1×10^{-4} $\delta k/k$. Hydraulic and static testing of MTR production fuel assemblies was made giving flow vs pressure drop, maximum flow rate at failure, and deflection to static pressure. The U^{233} cross section measurements are continuing. Total-minus-fission cross section subtractions, eta, and fission product mass asymmetries data were obtained. Preparations for gas scintillation fission counting are in progress, and total cross sections of Nd, Sm, Gd, and Pu^{240} were submitted for the cross section compilation. Initial scattering measurements (10 to 150 ev) on W were made. The low energy neutron velocity selector consisting of two phased rotors is under active development, and initial experimental results using a spinning sample technique are presented. Calculations of the gamma-ray detection efficiencies of different shapes of NaI crystals and extended sources were completed, and a 4.7 millisecond isomer in Pb^{201} was discovered. (For preceding period see IDO-16436.) (auth)

2552 IDO-16481

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

QUARTERLY PROGRESS REPORT FOR MTR-ETR TECHNICAL BRANCHES, SECOND QUARTER, 1958. P. W. Healy, ed. Sept. 8, 1958. 82p. Contract AT(10-1)-205. $2.25(OTS).

A full core loading (23 elements) of 20% enriched uranium operated the MTR for 646 megawatt days. The fuel plates in the elements of this loading were slightly thicker than those containing the 93% enriched uranium to accommodate the large total amount of uranium. The smallest critical configuration for the 20% core required 2060 grams of U-235, compared to 1850 grams for a 93% enriched core. The estimated resonance escape probability for the core was between 0.95 and 0.98. The excess reactivity for a 3×9 slab loading is about 13%. Statistical weights, temperature, and void coefficients were also determined. A considerable number of xenon transients were measured with the 20% MTR core, and the results compared with those calculated on the IBM 650 computer. Testing was begun on a number of sample fuel plates formed by pressure bonding in a hot press. Four out of twenty-four plates of thoria clad in aluminum developed blisters when subjected to temperatures of 300°F for one week. Determinations of boron content show that the boron contained in ETR fuel elements averaged only about 60% of the values given by the fabricator. A method of estimating the ETR charge life was developed which involves the summing of the contributions to k effective of the various fuel elements. The individual contributions are considered to consist of two parts, one of which is determined essentially by the material properties of the fuel and the other by the geometrical properties of the element. Theoretical results and preliminary experiments show that while the material properties change the leakage remains about the same during a cycle. A program to compare Ni, S, and Al as fast flux monitors was completed. The measurements indicate that the agreement among the three is quite good four inches from the reactor core, but becomes much poorer further from the core. The ratio of $\eta(U\text{-}233)/\eta(U\text{-}235)$ was measured in the RMF. Based on 1/v thermal absorption cross sections the value is 1.13. A gamma insensitive control system was investigated for the RMF. The total cross section of yttrium was measured on the crystal spectrometer. Fast chopper measurements are continuing on U-233, Ir-191, Ir-193, and Np-237. Recent eta measurements for U-233 are presented. Additional single crystal gamma spectrum measurements were on short-lived barium products, Ba-141 and Ba-142. The absolute disintegration rates of Nb-94 and Mo-93 were determined. The purification of 25 grams of fission product xenon was completed. A new and more rapid procedure was developed for separating carrier free bismuth from deuteron irradiated lead cyclotron targets. Ratios of the mass yields in the resonance fission of U-233 of Mo-99 to Ag-111 and Cd-115 were compared for a number of different neutron energy levels. Repeated observation of Fe-59 gamma radiation at this laboratory indicates the presence of one more level in Co-59 at 1.43 Mev which is fed by the β^- decay of Fe-59. (For preceding period see IDO-16474.) (auth)

2553 KAPL-1744

Knolls Atomic Power Lab., Schenectady, N. Y.

A STATISTICAL INVESTIGATION OF SUBCOOLED BURNOUT WITH UNIFORM AND LOCALLY PEAKED HEAT FLUXES. Cover carries title: A STATISTICAL STUDY OF SUBCOOLED BURNOUT INCLUDING THE EFFECTS OF LOCAL HOT SPOTS. J. Longo, Jr. Oct. 22, 1957. 45p. Contract W-31-109-Eng-52. $1.25(OTS).

Subcooled burnout was investigated for both locally peaked and uniform heat flux distributions. The burnout heat flux at the peak of a locally peaked distribution was found to be up to four times greater than the burnout heat flux of a uniform distribution for the same coolant conditions. (auth)

2554 KAPL-M-TR-313(Pt. 1)

Knolls Atomic Power Lab., Schenectady, N. Y.

CRITICAL HEAT FLUX DATA AT 2000 PSIA FOR SHORT TWISTED RIBBONS. R. C. Dowling and R. E. Kegan. July 31, 1958. 22p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

Tests were conducted at the Bettis Thermal and Hydraulics Laboratories on short, twisted ribbons under conditions of flow considered most critical during the loss of flow accident. These tests were the first portion of Test Program #313 to determine allowable values of fuel element heat flux. The object of these tests was to show that the thermal and hydraulic conditions during a loss of flow accident will not damage twisted ribbon fuel elements. "Critical heat flux" as used in this report refers to that heat flux at which a small increase in flux causes a sudden and large change of the ribbon temperature. Two critical heat flux values and three cases of film boiling were measured. In addition, scans were conducted with mass velocities from 0.75×10^6 to 1.75×10^6 lbs/hr ft^2 at arbitrary values of heat flux to demonstrate safe operating conditions for this type fuel element. The data obtained are not sufficient to formulate a correlation but give evidence that the burnout correlation used for the analysis of these accidents is conservative. Additional tests are scheduled to furnish a comparison with results for longer ribbons and to obtain a satisfactory correlation. (auth)

2555 LAMS-2240
Los Alamos Scientific Lab., N. Mex.
REACTOR COMPUTING PRACTICES. Carroll B. Mills. June 1958. 30p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

Recent work on the problem of anticipating the neutronics of high-power reactors by the study of relatively simple systems is summarized. Systems considered are H_2O, P_2O, Be, and C moderated reactors. (W.D.M.)

2556 MND-E-1157
Martin Co. Nuclear Div., Baltimore.
ERDL CRITICAL EXPERIMENTS. Hazards Summary Report. Dec. 1957. Decl. Oct. 23, 1958. 98p. $16.80 (ph OTS); $5.70(mf OTS).

The experimental reactor core is a heterogeneous, light water moderated, unpressurized, fully-enriched system that will operate at a maximum power of about ten watts. The criticality and nuclear characteristics tests for the zero power check point and power flattening experimental programs are described. A 2% step input analysis is presented and shown to produce a 62.2 Mw-sec energy release. The maximum credible incident is described and found to result in a series of 7 Mw-sec energy releases. Doses to surrounding areas due to a 62.2 Mw-sec excursion and 100% fission product release are discussed. A shielding analysis is presented to show that the radiation levels in the control room are safe for operating personnel. Information contained in this report supersedes information in reports MND-1110 and MND-1111. (W.D.M.)

2557 MND-RP-1256-1
Martin Co. Nuclear Div., Baltimore.
THE APPLICABILITY OF LIQUID FLUIDIZED BEDS TO NUCLEAR REACTOR DESIGN. C. C. Silverstein. Dec. 1956. 20p.

Presented before First Winter Meeting American Nuclear Society, Washington, D. C., December 10-12, 1956.

The known characteristics of fluidized beds are reviewed, and the applicability of the liquid fluidization process to reactor core design is examined. The liquid fluidized bed is qualitatively compared to both liquid homogenous and solid fueled heterogeneous cores. The critical mass of thermal water fluidized and fast liquid metal cores is shown as a function of the liquid fraction of the core. It is concluded that "fail-safe" operation of water fluidized cores is possible and that both water moderated and fast fluidized reactors may have a high degree of nuclear stability over a certain range of liquid core fractions. Estimates of the heat transfer properties of liquid fluidized cores are made for the case where the fluidizing liquid acts as the reactor coolant and the case where a separate reactor coolant is used. In both cases high rates of heat transfer are obtained; but permissible coolant velocities are restricted to relatively small values in the former case. Maximum bed pumping power requirements are found to be less than two kilowatts per cubic foot of core volume. Methods of controlling liquid fluidized cores are examined, and it is concluded that under some circumstances operation is possible without control rods. Preliminary experimental evidence is presented which indicates that particle attrition in liquid fluidized beds may occur at a significant rate. A possible conceptual design utilizing a liquid fluidized core is described. (auth)

2558 NP-7032
Battelle Memorial Inst., Columbus, Ohio.
HAZARDS SUMMARY REPORT FOR 2-MEGAWATT OPERATION OF THE BATTELLE RESEARCH REACTOR. Special Report. James N. Anno, Jr., Arnold M. Plummer, and Joel W. Chastain, Jr. Aug. 15, 1958. 21p. $4.80(ph OTS); $2.70(mf OTS).

The Battelle Research Reactor is a modified pool reactor located in a sparsely settled 500-acre tract owned by Battelle 13 miles west of Columbus, Ohio. The reactor has been operating since October 29, 1956, at power levels up to 1 megawatt. More than 300 megawatt-days have been logged on the reactor with most of this operation at a power level of 1 megawatt. No serious incidents have occurred during the operation of the reactor. With only a few modifications the reactor will operate continuously at a power level of 2 megawatts. First, interlock will be added to the safety instrumentation to scram the reactor in the event of significant reduction in the flow rate of the primary coolant. Second, to provide additional margin of safety against the possibility of local boiling occurring in the core, the primary flow rate will be increased to greater than 1500 gpm. Third, a 700-gallon holdup tank will be added to the primary coolant system to allow for decay of the nitrogen-16 formed in the coolant as it passes through the core. Holdup will reduce the dose rate at the surface of the pool to 4 mr per hr or less during routine 2-megawatt operation. Dose rates in vicinities of normal personnel activities will be less than the surface dose rate by at least an order of magnitude. Analyses of reactor safety and the hazards after an accident indicate that the change in hazards associated with the increase in power level is much less than a factor of two. It is concluded that the change in hazards does not significantly affect conclusions of the hazards analysis for 1-megawatt operation. (auth)

2559 NP-7041
North Carolina State Coll., Raleigh.
SUMMARY HAZARDS REPORT FOR NORTH CAROLINA STATE COLLEGE REACTOR NCSCR-4. C. M. Baldwin, Jr., D. B. Beman, H. B. Carter, H. A. Lamonds, J. W. Meeks, A. C. Menius, Jr., R. L. Murray, E. J. Story, and A. W. Waltner. Nov. 5, 1958. 103p. $16.80(ph OTS); $5.70(mf OTS).

An evaluation is presented of the hazards related to relocating the present Raleigh Reactor in a different building on the campus of North Carolina State College. Some of the experimental results on the present reactor are included which corroborate estimates made by the reactor staff prior to the initial critical experiment. Also the essential differences between the present reactor and the reactor in its new location are presented. These differences are primarily in the biological shield, the gas handling system, and the reactor building. (C.H.)

2560 RAG-8
Reaktor A. G., Würenlingen, Switzerland.
DIE NUMERISCHE LÖESUNG DES GRUNDPROBLEMS DER REAKTORDYNAMIK MIT HILFE EINES RECHENAUTOMATEN. (Numerical Solutions of the Basic Problems of Reactor Dynamics with the Aid of a Computer). Jean Patry. Sept. 4, 1958. 57p.

A method was developed and a corresponding calculation program drawn up to determine the dynamic behavior of a reactor with a consideration of the temperature effects. The program was based on the Ash theory with the expansions of Schmid which provides for the application of Laplace transforms and convolution integrals to this problem. The program was especially set up for the ERMETH, but can be adapted to all other machines

which have enough storage capacity (about 200 storage cells). A numerical application to the DIORIT shows the usefulness of the method, as well as some special phenomena which are briefly discussed. (tr-auth)

2561 WAPD-AT-172

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

OPERATING CHARACTERISTICS AND DESIGN OF A FULL STREAM BED FILTER FOR THE NRX-X-1 LOOP. L. A. Waldman. [Dec. 1955]. 23p. Contract [AT-11-1-GEN-14]. $4.80(ph OTS); $2.70(mf OTS).

The results demonstrate satisfactory performance of the reference design for full stream filtration in test loops. The bed filter may accumulate ~100 g of loop crud with a corresponding pressure drop of only 7.0 psi at 10 gpm (600°F), the operating full steam flow rate of the NRX-X-1 facility. The maximum pressure drop found for a fouled bed corresponded to 15.9 psi (600°F) at 18 gpm with 102 g accounted for in the bed. General operating characteristics of the bed, including leaching of the filtering media, retention of crud within the bed following filtration, and hydraulic parameters, are comparable with the application. A bed filter efficiency on the order of 85% may be expected for particulate suspensions of the same particle size as crud. (auth)

2562 WAPD-TM-157

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE SAMPLING ESTIMATE OF THE PARAMETER VARIANCE/MEAN IN REACTOR FLUCTUATION MEASUREMENTS. D. R. Harris. Aug. 1958. 22p. Contract AT-11-1-GEN-14. $0.75(OTS).

Reactor properties can be investigated by observing fluctuations in the number of counts occurring in a fixed time-interval in a neutron counter. The statistical parameter variance/mean of the count population may be estimated from the observed statistic $N[N-1]^{-1} \times$ variance/mean calculated for a sample of counts obtained in N time-intervals. It is shown that this method of estimation is biased, and a bound is derived for the magnitude of the bias. The bias can be severe when N is small and the mean number of counts per time interval is also small. The expected distribution of the sample statistic $N[N-1]^{-1} \times$ variance/mean is described. The results of the study are illustrated by analysis of actual reactor fluctuation data. (auth)

2563 WCAP-1029

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

TWO-REGION CRITICAL EXPERIMENTS; HAZARDS SUMMARY REPORT. P. W. Davison, D. Hunter, and J. Jedruch. Nov. 1958. 42p. $7.80(ph OTS); $3.30 (mf OTS).

The two-region critical experiments will be performed in the Westinghouse Reactor Evaluation Center (WREC) which is located on the Westinghouse Testing Reactor site at Waltz Mill, Pennsylvania. The two-region critical assembly will be a zero power thermal reactor having two distinct regions each of which is characterized by stainless steel clad, slightly enriched UO_2 pellet fuel elements moderated and reflected by light water. This assembly is similar to the UO_2 fueled Yankee and BR-3 experiments. The assembly was designed and will be operated on the basis of the experience obtained with similar existing reactors. (W.D.M.)

2564 YAEC-85

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

TWO DIMENSIONAL DIFFUSION THEORY STUDIES OF CONTROL ROD WORTHS AND FLUX PEAKING IN THE YANKEE REACTOR. George H. Minton and Gus Tirellis. Aug. 1958. 25p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $4.80(ph OTS); $2.70(mf OTS).

Procedures are discussed for the utilization of a two dimensional diffusion theory computer program (QED) in the calculation of neutron flux peaking and control rod worths. Some typical results obtained for the first Yankee core are presented. Methods for reducing large problems to a size acceptable to the computer program are described. (auth)

2565 AEC-tr-3434

MEASUREMENT OF THE REACTIVITY OF THE G-1. (Mesures de Réactivité Sur G-1). J. Bernot, J. C. Koechlin, L. Portes, and A. Teste du Bailler. Translated by Liz Appleby (Hanford Atomic Products Operation) from Report CEA-670(F), 1957. 30p.

Methods of measuring the variations in the effective multiplication coefficient of the G-1 as a consequence of a given change in its geometry were investigated. (auth)

2566

FUNDAMENTAL ASPECTS OF THE DYNAMICS OF THERMAL REACTORS. Federico Goded Echeverria. Energia nuclear (Madrid) 1, 49-58(1957) Jan.-Mar. (In Spanish)

The dynamics of nuclear reactors are studied as an introduction to the problems which the operation of a nuclear power plant presents. In the first section of the paper, the effect of temperature without delayed neutrons and the combined effect of temperature and delayed neutrons are considered. (J.S.R.)

2567

FUNDAMENTAL ASPECTS OF THE DYNAMICS OF THERMAL REACTORS. II. Federico Goded Echeverria. Energia nuclear (Madrid) 1, No. 2, 38-44(1957) Apr.-June. (In Spanish)

In the second part of the introduction to the dynamics of thermal reactors, the discussion on the combined effect of temperature and delayed neutrons is concluded. The special aspects of homogeneous and boiling water reactors are considered. (J.S.R.)

2568

FUNDAMENTAL ASPECTS OF THE DYNAMICS OF THERMAL REACTORS. III. Federico Goded Echeverria. Energia nuclear (Madrid) 2, No. 5, 59-66 (1958) Jan.-Mar. (In Spanish)

In the concluding part of the article on reactor dynamics, the discussion on the special aspects of homogeneous and boiling water reactors is concluded. The influence of secondary variables is considered. (J.S.R.)

2569

SAFETY OF NUCLEAR REACTORS. Fernando Saleta Sanabria. Energia nuclear (Madrid) 2, No. 6, 17-23 (1958) Apr.-June. (In Spanish)

A survey is made of the safety features incorporated in a reactor to ensure that no nuclear accident occurs. In addition to the built-in safeguards, the alarm systems and the safety precautions are discussed. It is estimated that in the United States with over 100 reactors in operation the chance of a person being killed by a nuclear incident in a year is 1/50,000,000. (J.S.R.)

2570

CALCULATION OF THE PURIFICATION SYSTEM OF WATER REACTORS. Agustin Alonso Santos. Energia

nuclear (Madrid) 2, No. 6, 24-33(1958) Apr.-June. (In Spanish)

A mathematical analysis is made of the water purification system of a water-moderated reactor. (J.S.R.)

2571

CALCULATION OF THE SHIELDING IN NUCLEAR REACTORS. Alberto Carbó Vila. Energia nuclear (Madrid) 2, No. 6, 43-7(1958) Apr.-June. (In Spanish)

The methods for calculating the shielding in nuclear reactors are discussed. (J.S.R.)

2572

ACTUAL IMPRESSION OF THE NUCLEAR PROGRAM ON THE ELECTRICAL INDUSTRY OF SPAIN AND OTHER EUROPEAN COUNTRIES. Jose Luis Redonet Maura. Energia nuclear (Madrid) 2, No. 7, 23-33(1958) July-Sept. (In Spanish)

The economic effect of nuclear power on the electrical industries of Spain, West Germany, France, and Great Britain is discussed, with emphasis on nuclear power in Spain. (J.S.R.)

2573

THE PERTURBATION THEORY. José A. García Fite. Energia nuclear (Madrid) 2, No. 7, 68-79(1958) July-Sept. (In Spanish)

The use of the perturbation theory in calculating the effect small changes in various parameters have on reactor reactivity is discussed. The necessary functions are given, and the general formula for the reactivity is derived. The equations describing the effects of the presence of gaps in the core, temperature, fuel burn-up, xenon, and control rods are given. (J.S.R.)

2574

APSARA, ASIA'S FIRST NUCLEAR REACTOR. A. S. Rao (Atomic Energy Establishment, India). Nuclear Eng. 3, 491-3(1958) Nov.

The reactor is of the swimming pool type—a light water moderated and reflected heterogeneous reactor, using enriched uranium as fuel. The reactor is used for training, some radioisotope production, and research in physics, engineering, and biology. The reactor is designed to operate at a maximum power level of 1 Mw(h). The instrument and control channels are described in detail. (W.D.M.)

2575

FABRICATING THE TUBE NEST FOR THE DOUNREAY CORE. TOOLROOM TECHNIQUES REQUIRED TO MEET SPECIFICATIONS. Nuclear Eng. 3, 494-5 (1958) Nov.

The machining techniques used to meet the very close tolerances on the core plates, tubes, and side plates for the Dounreay Fast Reactor core are discussed. All components are of stainless steel which made the machining problems difficult. (W.D.M.)

Power

Refer also to abstracts 2621 and 2624.

2576 AERE-CE/M-241

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

STEAM CYCLES FOR HOMOGENEOUS AQUEOUS REACTORS. W. S. Cummins and C. L. Brown. July 1958. 21p. $0.39(BIS).

The optimum steam conditions for the HAR are calculated to be 420 psia (Dry Saturated) by a method based on the work of Lundgren & Seippel. In addition, consideration has been given to the steam cycle and the mechanical equipment. An appendix outlines a study contract which could be placed in order that further detailed work be carried out on steam cycles for the HAR. (auth)

2577 AERE-CE/R-2615

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

HOMOGENEOUS AQUEOUS POWER REACTORS CORE FLUID PROCESSING RATES. R. G. Tongue and T. R. Jenkins. Sept. 1958. 42p. (HARD(B)/P-13). $0.84 (BIS).

Neutron poisons can be removed from homogeneous aqueous reactors by many types of processes. The equilibrium value of neutron capture cross-section of the total poisons depends on the rate of processing. Methods are given for calculating equilibrium poison levels for various types, combinations, and rates of processing. Numerical examples illustrate the methods for a reference power reactor system. (auth)

2578 APAE-37

Alco Products, Inc., Schenectady, N. Y.

APPR-1 RESEARCH AND DEVELOPMENT PROGRAM. DESIGN ANALYSIS FOR FLOW AND TEMPERATURE MEASUREMENT PROGRAM. Task No. V. W. M. S. Richards, ed. Sept. 26, 1958. 115p. Contract AT(30-3)-326. $2.25(OTS).

Analysis and design, the engineering and fabrication requirements for modifying reactor components, and developing and installing the necessary instrumentation to carry out a fuel temperature and flow measurement experimental program were established. (auth)

2579 APAE-38

Alco Products, Inc., Schenectady, N. Y.

PLANT TRANSIENT ANALYSIS OF THE APPR-1 BY ANALOG COMPUTER METHODS. Task No. IV. Phase I—J. O. Brondel. Phase II—J. R. Tomonto. Oct. 1, 1958. 204p. Contract AT(30-3)-326. $25.80 (ph OTS); $7.80(mf OTS).

A general mathematical model was established for the primary system loop of pressurized water reactors which will respond to steam generator load and control rod reactivity changes in essentially the same manner in corresponding plants. The fidelity of the analytically derived model was demonstrated by using design parameters of the APPR-1 in the general equations, and by comparing the transient response of this plant and its model to similar perturbations. The simultaneous differential equations representing a kinetic model of the APPR-1 were programmed for the ALCO electronic analog computer. It is assumed that the general model is applicable to other reactors of similar type. (J.R.D.)

2580 BNL-2432

Brookhaven National Lab., Upton, N. Y.

LIQUID BISMUTH AS A FUEL SOLVENT AND HEAT TRANSPORT MEDIUM FOR NUCLEAR REACTORS. O. E. Dwyer, D. H. Gurinsky, and J. R. Weeks. [1955]. 51p. $7.80(ph OTS); $3.30(mf OTS).

Liquid bismuth as a heat-transfer medium and the design and operation of reactor systems in which it is used are discussed. Much of the information presented was obtained at the Brookhaven National Laboratory in connection with the development of the LMFR, or liquid-metal-fuel reactor. In addition, discussions of such factors as pumping-power requirements, metallurgical

problems, heat transfer, radioactivity, chemical reactivity, and nuclear considerations are presented. In treating some of these topics, bismuth is compared with other typical reactor coolants. (auth)

2581 BNL-3489
Brookhaven National Lab., Upton, N. Y.
A LIQUID METAL BREEDER BLANKET FOR POWER REACTORS. J. S. Bryner, R. J. Teitel, and M. B. Brodsky. [Dec. 12, 1957]. 22p. $4.80(ph OTS); $2.70 (mf OTS).

Investigations thus far indicate that dispersions of $ThBi_2$ in liquid bismuth and lead-bismuth eutectic fulfill the requirements of breeder-blanket material with respect to neutron economy, ease of preparation, economic processing and reconstitution, stability, containment, and amenability to remote handling. The results have been obtained almost entirely from small scale experiments. Much work will be necessary to scale up the various processes to the sizes required in blanket operations. The many desirable features of these dispersions justify expending considerable effort to solve the outstanding problems. (auth)

2582 CF-58-10-37
Oak Ridge National Lab., Tenn.
U^{233} BREEDERS — COMMENTARY AND GENERAL REMARKS. W. K. Ergen. Oct. 8, 1958. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

Breeding is expected to become a necessity in about 40 years and in view of the 20 years development time and 30 years service life of breeder reactors, development of such reactors at present is timely. In plutonium breeders, the specific power is inherently low and the doubling time long. This seems to prevent such breeders from furnishing a large fraction of the energy demands of the expanding economy from uranium recoverable at or about present cost. U^{233} breeders can be designed to the requirements of low inventory and short doubling time, but the aqueous homogeneous reactor seems to be the only type which can adequately meet these requirements. (auth)

2583 CRCE-800
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE INTERNAL INSULATION OF REACTOR PRESSURE TUBES. I. HEAT TRANSFER STUDIES OF LAYERS OF STAGNANT WATER. D. H. Charlesworth and R. E. Hollies. Aug. 1958. 54p. (AECL-687). $1.50(AECL).

The use of thermal insulation internal in reactor pressure tubes restricts the tube-wall temperature and thus permits the consideration of aluminum and magnesium alloys as pressure-tube materials. In loop experiments, stagnant water showed promise as internal insulation. Of the two methods for suppressing convection which were studied, the subdivision of the water into thin layers proved superior by a factor of two on an over-all insulation basis to the addition of powder as a stabilizing structure. Experimental results confirmed that the heat transfer across a water-filled horizontal annulus by natural convection is well correlated by the equation of Kraussold. Dimpled-foil spirals are a practical method for subdividing the insulation space into layers sufficiently thin to suppress convection. (auth)

2584 HW-56362(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
GAS COOLED POWER REACTOR COOLANT CHOICE. H. W. Heacock and R. E. Nightingale. June 12, 1958. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80 (mf OTS).

The current status of helium and carbon dioxide technology is described in the light of the Gas Cooled Reactor Program requirements. The problem of containing high-pressure helium at high temperature is discussed, and it is concluded that, by proper attention to the design, construction and maintenance of a plant, a high degree of helium leak-tightness can be achieved at small additional cost when compared with a carbon dioxide system. What is more, the cost of making up helium losses in a practically achievable system is estimated to be small compared with other fixed and operating costs. Graphite-carbon dioxide reaction data are reviewed. It is shown that carbon dioxide at atmospheric pressure and low flow rates should be compatible with a graphite moderator up to 525°C. No data are available at the high pressures and flow rates that would be encountered in power reactors. Significantly higher oxidation rates may result, however, perhaps limiting bulk moderator temperatures to 450 to 500°C. Improved carbon materials, protective coatings and inhibitors, and/or operating practices may be developed that will allow significant future increases in these limiting temperatures. (auth)

2585 NAVORD-5748
Naval Ordnance Lab., White Oak, Md.
AN INVESTIGATION OF STRAIN — ENERGY ABSORPTION POTENTIAL AS THE CRITERION FOR DETERMINING OPTIMUM REACTOR — VESSEL CONTAINMENT DESIGN. Comprehensive Progress Report for the Period January 9, 1956 to June 30, 1958. Walter R. Wise, Jr. June 30, 1958. 177p. Task Number NOL-285: DAMAGE FROM EXPLOSION OF NUCLEAR REACTORS. $3.00(OTS).

It is postulated that strain-energy absorption, achieved through the medium of large plastic deformation, is a means for substantially improving the containment potential of nuclear reactors. It follows that strain-energy absorption potential is one of the important containment-design criteria. Consistent with the criterion of strain-energy absorption potential, the general strain-energy equation of dynamic equilibrium for a vessel subjected to internal dynamic loading has been derived in closed form. This general equation and its simplified working forms require knowledge only of the transient-pressure and strain-vector phenomena accompanying hydrostatic and dynamic dilatation. Scaled reactor-vessel simulants have been dilated in the laboratory using a hydraulic pump and solid propellant, respectively, as the hydrostatic and dynamic loading mechanisms. The internal pressures and external strain vectors corresponding to the dilatations were monitored, and comprehensive analyses of structural response data are presented in tabular and graphical form. The results obtained prove conclusively that the mechanism of strain-energy absorption can be very effective in improving the containment design of nuclear reactors. It is likewise concluded from the general results of the work that the approach to the problem is technically and economically sound and that it will yield the fundamental technology required to achieve optimum containment design of nuclear reactors. (auth)

2586 WAPD-CDA(1)-88
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh].
PWR FISSION PRODUCT ACTIVITY LEVELS. K. H.

Vogel, P. W. Frank, and P. Cohen. [May 1958]. 16p. $3.30(ph OTS); $2.40(mf OTS).

Attached to this report is a letter containing pertient information (WAPD-PWR-1481) from J. C. Rengel, dated May 17, 1958. 4p.

Recent radiochemical investigations of the PWR reactor coolant have confirmed earlier observations that the level of activities of 33 m Cs^{138}, 2.8 hr Kr^{88}, and 8.1 day I^{131} are more than ten times higher than those predicted for the estimated U contamination of the Zircaloy cladding. The present fission product activity levels have not, as yet, presented any problems in the PWR. (W.L.H.)

2587 WAPD-PWR-RD-566

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. PROCEDURES FOR THE ASSEMBLY, INSTALLATION AND TESTING OF PWR CORE 1 REACTOR COMPONENTS AND HANDLING EQUIPMENT. Sept. 1958. 449p. Contract AT-11-1-GEN-14. $73.80(ph OTS); $11.10(mf OTS).

The procedures prepared to facilitate the safe and proper assembly, installation, and check-out of the Shippingport Pressurized Water Reactor Core 1 components, including the associated refueling and handling equipment which were supplied by the PWR Design Subdivision, are presented. Requirements are included for: pre-installation core assembly at Bettis and subsequent reassembly at Shippingport, pre-installation operations on handling equipment and reactor vessel head and head appurtenances, and reactor installation. A plan list for the vessel and core as well as several over-all views of the reactor are included. (W.D.M.)

2588 NP-tr-183

NUCLEAR PROPULSION FOR AIRCRAFT AND ROCKETS. (Naped Jadrowy Samolotow i Rakiet). O. Wolczek. Translated for Wright-Patterson AFB from p.102-55, Part V, of Newest Aviation Designs, Collection of Articles. (Najnowsze Konstrukcje Lotnicze, Prace Zbiorowe). Warsaw, 1957. 91p.

Nuclear reactors are reviewed for possible application to aircraft and rockets. Thermonuclear research done in the various countries is summarized. The different types of propulsion systems for aircraft and rocket systems are described and the contributions of the various countries are discussed. (W.D.M.)

2589

THE FAST NEUTRON BREEDER REACTOR: THE "ENRICO FERMI." M. Van Dievoet. Bull. Inform. Assoc. belge develop. pacifique energie atomique No. 15, 5-12(1958) July. (In French)

The heat exchange system in the Fermi Fast Breeder Reactor is described. The primary circuit, the intermediate circuit, the water–steam circuit, and the natural circulation circuit for accidental loss of pumping power are discussed. (J.S.R.)

2590

ADVANTAGES AND DISADVANTAGES OF DIFFERENT TYPES OF REACTORS. McLain (Argonne National Lab., Lemont, Ill.). Energia nuclear (Madrid) 1, No. 2, 25-37(1957) Apr.-June. (In Spanish)

The advantages and disadvantages of several types of reactors are reviewed qualitatively. A comparison is made of thermal and rapid reactors and of heterogeneous and homogeneous reactors. Reactors moderated and cooled by water are considered with a special discussion of boiling water reactors. Gas-cooled reactors are also discussed. (J.S.R.)

2591

THE COST OF NUCLEAR ENERGY IN 1957. James A. Lane (Oak Ridge National Lab., Tenn.). Energia nuclear (Madrid) 1, No. 4, 13-22(1957) Oct.-Dec. (In Spanish)

An examination is made of the present situation with respect to the economics of nuclear power, with the object of investigating whether the kilowatt price of nuclear power plants can be reduced. The cost of the fuel is also considered. The future economic competition of nuclear power plants with conventional fuels is also discussed. (J.S.R.)

2592

COMPARATIVE STUDY OF THE USE OF NATURAL OR ENRICHED URANIUM AS FUELS IN POWER REACTORS. W. B. Lewis (Atomic Energy of Canada, Ltd., Chalk River, Ont., Can.). Energia nuclear (Madrid) 2, No. 5, 35-43(1958) Jan.-Mar. (In Spanish)

A comparison is made of the advantages and disadvantages of the use of natural and enriched uranium as fuels in power reactors. The conclusion is made that in many circumstances natural uranium is the better fuel. (J.S.R.)

2593

NUCLEAR POWER STATIONS IN THE UNITED KINGDOM. Oscar Jiménez Reynaldo. Energia nuclear (Madrid) 2, No. 5, 44-53(1958) Jan.-Mar. (In Spanish)

The development of nuclear power plants in the United Kingdom is discussed. The stations at Berkeley, Bradwell, Hunterston, and Hinkley Point are described in some detail. (J.S.R.)

2594

PRESSURIZED LIGHT WATER REACTORS. Guillermo Velarde. Energia nuclear (Madrid) 2, No. 6, 48-68(1958) Apr.-June. (In Spanish)

The characteristics of the Shippingport Pressurized Water Reactor, the Yankee Power Reactor, and the Consolidated Edison Reactor at Indian Point are described. The economic possibilities and future development of pressurized water reactors are discussed. (J.S.R.)

2595

COMPARISON OF BOILING WATER REACTORS WITH OTHER TYPES OF POWER REACTORS. H. Bergua and L. Palacios. Energia nuclear (Madrid) 2, No. 7, 60-7 (1958) July-Sept. (In Spanish)

A comparison is made of the boiling water reactors with the pressurized water reactor and the gas-cooled, graphite-moderated reactors of the Calder Hall type. The initial cost, operating characteristics, maintenance cost, and future development are considered. (J.S.R.)

2596

A NUCLEAR WHALER. George K. Brokaw and Robert Gordon (Aerojet-General Nucleonics), Jean Jeffres (Saclay), Balraj Sehgal and Nathan W. Snyder (Univ. of California). Nuclear Eng. 3, 471-6(1958) Nov.

A study of the application of nuclear propulsion for a whaling factory ship is presented. It is suggested that an economic feasibility exists in this case where the reactor can supply propulsive power, process steam, and isotopes for the irradiation processing of the whale meat. The proposed reactor is a bare 35 Mw(h) pressurized water type surrounded by a blanket of In^{115} to breed In^{116} for use as an irradiation source. Design and characteristics of the reactor are given along with a brief economic justification of the system. (W.D.M.)

2597

DESIGNING PUMPS AND BLOWERS FOR NUCLEAR

POWER PLANTS. R. A. Strub. Nuclear Power 3, 592-4(1958) Dec.

Problems in designing machines for use in the circulation of reactor coolants are discussed. Information is included on: the influence of gases on the performance of radial and axial compressors, circulation pumps, the EDF-1 axial blower, and shaft seals. (J.H.M.)

2598

SOME DESIGN CONSIDERATIONS IN GAS COOLED REACTORS. H. West and A. L. Shaw. Nuclear Power 3, 598-9(1958) Dec.

Major differences in the design of the British Mk 1 nuclear power stations are summarized. For pressure vessels there are sound arguments in favor of both the sphere and the cylinder. (J.H.M.)

2599

BELLOWS EXPANSION JOINTS FOR GAS DUCTING. Nuclear Power 3, 607-8(1958) Dec.

Bellows joints for gas ducting in the Berkeley, Hunterston, and Hinkley Point nuclear power stations are described. Tests on the 5 ft 6 in. Hinkley Point bellows are discussed. These included a life test at 230 psi, 770°F, and a bursting test. Both tests were to destruction. The bellows tested was $\frac{1}{8}$ in. thick of 1% Cr, 0.5% Mo steel, heat treated after forming. Convolutions were of about $1\frac{1}{2}$ in. pitch with a height of $2\frac{1}{2}$ in. Eight convolutions were used for the life test and 5 for the bursting testing. The tests were considered very satisfactory. (J.H.M.)

2600

NUCLEAR ENERGY IN INDUSTRY. J. G. Crowther. London, George Newnes Limited, 1956. 173p.

Nuclear energy is defined, and the various kinds of reactors are described. Applications of nuclear energy in the production of nuclear power are discussed. Industrial uses of isotopes are summarized. The world sources of uranium and the development of new methods in metallurgy and technology are discussed. (C.H.)

TECHNOLOGY

Feed Materials

2601 NLCO-747

National Lead Co. of Ohio, Cincinnati.

THE RECOVERY OF MAGNESIUM AND HF FROM MAGNESIUM FLUORIDE: A LITERATURE SEARCH. Earl W. Mautz. May 26, 1958. 26p. Contract AT(30-1)-1156. $1.00(OTS).

Literature references relating to the recovery of Mg and Hf from MgF_2 are presented. Reports on the manufacture of HF are comprehensively included. (auth)

2602

UF_6–3NaF COMPLEX FORMATION AND DECOMPOSITION. G. I. Cathers, M. R. Bennett, and R. L. Jolley (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 50, 1709-10(1958) Nov.

The reversible absorption of gaseous uranium hexafluoride on solid sodium fluoride is convenient for trapping, handling, and storing this material in chemical processing. The UF_6 is absorbed by the formation of UF_6·3NaF, a yellow hygroscopic solid complex. Absorption and desorption involve an equilibrium among UF_6, NaF, and UF_6·3NaF. The vapor pressure of UF_6 over the solid complex conforms to the equation $\log p = 10.88 - 5.09 \times 30^3/T$ from 80° to 360°C. A competing reaction, which interferes with UF_6 desorption, involves decomposition of the U(VI)-NaF complex to a white U(V)-NaF complex. The rate of the decomposition from 250° to 350°C., is expressed as $\log k = 6.09 - 5.22 \times 10^3/T$. By maintaining an excess of fluorine and sweeping UF_6 from the complex as liberated, this reaction is reversed to allow quantitative desorption of uranium. (auth)

Raw Materials

Refer also to abstract 2609.

2603

PREPARATION OF PURE COMPOUNDS OF URANIUM FROM ORE. Karel Seidl. Chem. prumysl 7, No. 6, 297-9(1957). (Translated from Referat. Zhur. Khim. No. 5, 1958, Abstract No. 15047).

A brief review on the processes for the preparation of uranium compounds from ores is presented. 8 references. (J.S.R.)

PATENTS

2604

THERMOELEMENTS IN NUCLEAR FUEL ELEMENT SPACE OF A REACTOR FOR POSSIBLE TRANSFORMATION OF NUCLEAR TO ELECTRICAL ENERGY. (to Siemens-Schuckertwerke AG). German Patent 1021962. Atompraxis 4, 341-2(1958). (In German)

2605

PHOTOGRAPHIC EMULSIONS WITH HIGH SENSITIVITY FOR X AND GAMMA RADIATION BY THE ADDITION OF SMALL AMOUNTS OF CADMIUM. (to General Aniline & Film Corp.). German Patent 1022468. Atompraxis 4, 342(1958). (In German)

2606

APPARATUS FOR THE DETECTION OF NEUTRONS WITH A SEMI-CONDUCTOR. (to Siemens-Schuckertwerke AG). German Patent 1025533. Atompraxis 4, 342(1958). (In German)

2607

NEW KIND OF STORAGE INSTALLATION FOR RADIOACTIVE SUBSTANCES. (to August Hofmann). German Patent 1026011. Atompraxis 4, 342(1958). (In German)

2608

METHOD FOR THE MEASUREMENT OF RADIOACTIVE POISONS IN LIQUIDS BY PRODUCTION OF A LIQUID SURFACE WHICH DOES NOT COME IN CONTACT WITH THE RADIATION DETECTOR. (to Frieseke & Hoepfner GmbH.). German Patent 1023530. Atompraxis 4, 342(1958). (In German)

2609

PROCESS FOR PRODUCTION OF URANIUM HEXAFLUORIDE. (to United Kingdom Atomic Energy Authority)(U.S.A.). British Patent 794,023. Nuclear Eng. 3, 510(1958) Nov.

Uranium hexafluoride is produced by the reaction, at elevated temperature, of anhydrous uranyl fluoride with elemental fluorine. (W.D.M.)

2610

CATALYSTS FOR FLUORINATION. (to United Kingdom Atomic Energy Authority)(U.S.A.). British Patent 794,022. Nuclear Eng. 3, 510(1958) Nov.

When fluorine reacts with hydrocarbon the heat pro-

duced tends to establish large temperature differences between different parts of the catalyst mass which slows up the reaction. By plating a metal (copper) inert in fluorine with silver, cobalt, manganese, or cerium a good catalyst material is produced whose high thermal conductivity reduces the temperature differences.

2611

ELECTROMAGNETIC RADIATION DEVICES. (to Industrial Nucleonics Corp.)(U.S.A.). British Patent 794,207. Nuclear Eng. 3, 510(1958) Nov.

In order to obtain radiation of a predetermined average energy a target of preselected characteristics is interposed between a beta-emitting radioisotope and the material. The target should be so thick as to stop at least 98% of the beta rays. Electromagnetic radiation of a desired energy is emitted. The intensity of the radiation passing through the material is measured by a suitable detector.

2612

PROCESS FOR EFFECTING NUCLEAR FISSION REACTIONS. (to Stichting Reactor Centrum Nederlands) (Netherlands). British Patent 794,224. Nuclear Eng. 3, 510(1958) Nov.

The nuclear fuel is circulated in the form of a solution or suspension of fissile material through the reactor and through a heat exchanger. Flow through the reactor is effected under gravity. The solution or suspension is then carried upwards through a vertical riser by injection of gas at the lower end and the gas is separated again at the highest point. Where ordinary or heavy water is used as carrier liquid it has been found particularly advantageous to employ as the injection gas, a gas wholly or mainly of hydrogen or deuterium. The position of equilibria of the various possible decomposition reactions under the influence of radiation is mainly determined by the hydrogen or deuterium concentration. An increase in the hydrogen or deuterium concentration promotes reformation of water whereas an increase in the oxygen concentration promotes decomposition of the water. Excess hydrogen or deuterium in the gas circuit, therefore, operates as a safeguard. The gas separated from the fuel solution or suspension is at least partly freed, before it is recycled, of gaseous fission products and oxygen.

2613

NUCLEAR REACTOR AND METHOD OF OPERATING NUCLEAR REACTORS. (to Babcock and Wilcox, Ltd.) (Ger.). British Patent 794,329. Nuclear Eng. 3, 510 (1958) Nov.

The operating temperature of carbon dioxide-cooled reactors is limited by the maximum temperature of the canning material for the fuel elements. Canning is required because otherwise radioactive gases developed during fission tend to interfere with the operation. It is, however, possible to utilize core fuel which is not enclosed in gas-tight cans when the undesirable gaseous products evolved by the fuel are removed from the coolant by a solvent which exerts a selective dissolving action. In this arrangement the carbon dioxide which circulates in a closed circuit, is continuously dissolved after cooling has taken place in the heat exchanger under pressure in water. The insoluble xenon together with a part of the carbon dioxide is blown off through a valve. The carbon dioxide solution is then degasified in a low-pressure vessel and returned into the circuit.

2614

PROCESS FOR SEPARATING URANIUM. (to United Kingdom Atomic Energy Authority)(U.S.A.). British Patent 794,490. Nuclear Eng. 3, 510(1958) Nov.

U.S. Patents Nos. 2,709,222, 2,758,006, and 2,771,340 refer to the production of uranium enriched with U^{235} employing the "calutron" method for separating the constituent isotopes of an element in several stages. A final salvage treatment is important because an oxalate solution of relatively large volume is left which contains singly enriched uranium. The usual process, however, is difficult to operate on a large scale. In the new method, the solution is admitted to the anode compartment of a mercury cathode electrolytic cell whose cathode compartment contains a hydrochloric acid solution. The compartments are separated by an ion-permeable barrier of a ceramic insulating material which prevents mechanical passage of liquid. The uranium containing solution is then subjected to electrolysis in the cell causing transfer of uranium ions to the acidic solution in the cathode compartment. The metallic impurity is deposited in the mercury of the cathode.

2615

HIGH PRESSURE CLOSURE. (to Babcock and Wilcox Co.)(U.S.A.). British Patent 794,551. Nuclear Eng. 3, 510(1958) Nov.

The closure of a pressure vessel for high pressure and/or high temperatures has to be removable for repair or maintenance. Often remote operation is necessary so that heavy bolted flanges cannot be used. Vessel and closure are, therefore, made with flanges held together by C-shaped clamps arranged adjacent to each other around the periphery. Each clamp is pressed on to the oppositely inclined faces of the flanges by a clamping ring axially moved by jack screws to exert a wedging action, inclined plane faces engaging corresponding faces on the C-clamps. The jack screws may be driven by gear mechanisms in combination with a rotating gear ring.

2616

NUCLEAR REACTOR. (to Cie. Francaise Thomson-Houston)(France). British Patent 794,614. Nuclear Eng. 3, 510(1958) Nov.

Local increase of temperature by accidental stopping of the calorific flow by ebullition when a large quantity of vapor renders heat exchange contact between the fuel element and the liquid surrounding uncertain, can be dangerous. The temperature may become so high as to destroy the structure. It can be avoided by forced rapid circulation of the liquid under pressure. Ebullition can be tolerated when the flow of heat in the most loaded zone is limited to a value remote enough from the critical flow of heat. In the new arrangement, the formation of a continuous film of vapor on the surface of an element is prevented by a surface configuration of the element casing with corrugations and protuberances enlarging the surface in contact with the liquid two to four times of the plain solid.

2617

IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. A. T. Bowden and E. Smart. (To C. A. Parsons & Co., Ltd.) British Patent 803,701. Oct. 29, 1958. Nuclear Power 3, 622(1958) Dec.

This is a control system with no moving parts, performing the functions of shutdown and power control, and a means of adjusting flux distribution. It comprises tubes in the core filled with a neutron absorbing fluid,

formed of a variable mixture of two components. Fluid is supplied to the reactor tubes from a main reservoir by a pump to a constant head mixing tank. After adding either constituent as required, the fluid is circulated through the re-entrant core tubes. A suitable fluid is an aqueous solution of a cadmium salt.

2618

PROCESS AND APPARATUS FOR EFFECTING NUCLEAR FISSION REACTIONS. (to Stichting Reactor Centrum Nederland). Aug. 27, 1958. British Patent 800,526. Nuclear Power 3, 572(1958) Nov.

Applicable in either heterogeneous or homogeneous reactors, this is a circulation system for granular fuel. Passage through the reactor under gravity is simple enough—the problem lies in sending it up through the heat exchangers. Fuel is discharged from the reactor tube into a conical vessel attached through a stem to a vibrator. Carrier gas entering through a duct is preheated by contact with the conical vessel and, flows over the top of the core and is forced to flow through the fluidized fuel before leaving through the exit conduit. Fluidization of the fuel is achieved by vertical vibration of the vessel and circulating currents are set up. If the incoming gas has sufficient velocity it suspends the fuel and takes it through the discharge conduit. Rate of transfer of the fuel can be controlled by the frequency and/or amplitude of the vibrator.

2619

MANUFACTURE OF CLAD FUEL ELEMENTS. (to Atomic Energy of Canada, Ltd.). Aug. 27, 1958. British Patent 800,470. Nuclear Power 3, 572(1958) Nov.

Using a 300-ton vertical hydraulic extrusion press, fuel bars are clad with aluminum by direct extrusion. Previous nickel plating of the fuel, and possibly a copper flash as well, is found to improve the bonding and also prevents oxidization when heated in the press. When extrusion begins a solid aluminum ribbon is first formed and as the leading edge of the fuel bar moves forward in the press the sheath is formed round it as a continuation of the ribbon. A second solid ribbon at the rear end of the bar seals the sheath and continues to be formed until the arrival of the next element. Thus the operation may be repeated indefinitely to form a series of elements.

2620

IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. H. M. Finniston (to United Kingdom Atomic Energy Authority). Aug. 27, 1958. British Patent 800,671. Nuclear Power 3, 572 (1958) Nov.

Designed for use at high temperatures—600°C or higher—this fuel element comprises a mixture of finely divided fuel and liquid metal contained in a narrow annular sheath. Fuel may be Pu^{239}, natural or enriched uranium, U^{233}, intermetallic compounds of these with melting point below 700°C, or their chemical compounds stable up to 600°C. This may form either a settled slurry in the liquid metal when the volume ratio of fuel to metal would be about 66:34, or a suspension when the fuel would amount up to 40% of the combined volume. Particle size should be 10 microns or less. The double-walled container is corrosion resistant with an annulus of $\frac{1}{16}$ to $\frac{1}{10}$ inch. Coolant is metal, preferably the same as in the element itself. Some control of the reactor may be obtained by drawing off the slurry.

2621

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR CONTROL MECHANISM. (To Rolls-Royce, Ltd.) British Patent 803,708. Oct. 29, 1958. Nuclear Power 3, 622(1958) Dec.

Improvements for a reactor control system have been proposed by Rolls-Royce. The system is space saving because the control elements do not protrude from the reactor when removed. Schematics are shown of the new system. (J.H.M.)

2622

PROCESS FOR THE DESTRUCTION OF RADIOACTIVE RESIDUES. (To Louis Verchraeghen.) British Patent 802,971. Oct. 15, 1958. Nuclear Power 3, 622(1958) Dec.

To overcome the problem of disposal of radioactive fission products, this patent suggests exposing them to radiation to convert them into stable or short-lived isotopes. This may be done either in an accelerator or in a reactor e.g. in the fuel rods or moderator of a heterogeneous reactor or in pipes or the control rods in a homogeneous one. Where possible an energy-yielding reaction is chosen. Separation of the resulting isotopes may be done by physical, chemical, or physicochemical methods if they are in the same phase as the residue, or by filtration, decantation etc. if in a different phase.

2623

IMPROVEMENTS IN THE COOLING OF NUCLEAR REACTORS. (To Union Carbide Corp.) British Patent 802,938. Oct. 15, 1958. Nuclear Power 3, 622(1958) Dec.

Union Carbide suggest using niobium pentafluoride as a reactor coolant. Its great advantage is that, while solid at room temperature, its melting point is 80°C and it boils at 234.9°C. Its latent heat of vaporization is 12.9 kilocalories and since it changes state at the temperature of the reactor, a small volume of it will absorb a large quantity of heat. No pumping is required because the vapor rises upwards into the heat exchanger, is condensed and flows back into the bath.

2624

IMPROVEMENTS IN OR RELATING TO NUCLEAR FUEL ELEMENTS. (to Babcock & Wilcox Ltd.). Aug. 27, 1958. British Patent 800,397. Nuclear Power 3, 572(1958) Nov.

To prevent build-up of pressure inside a fuel element sheath due to release of gaseous fission products, Babcock & Wilcox propose making the rods with internal cavities suitably placed to avoid disturbing heat transfer. Two designs are suggested: in one the uranium is in the form of short bars with interlocking part-spherical ends and a coaxial bore giving communication with the sheath interface at the end of the bar and at the section joints. In the other a series of diametrical holes are made in the rod, angularly displaced to each other along the length of the bar. Contact between the fuel and sheath is thus interrupted only at the small areas of the orifice holes.